

NBS REPORT

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THE BASIC CONCEPTS AND MANAGEMENT

WITHIN THE U.S.A. OF PRECISE TIME AND FREQUENCY

J. A. Barnes



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This report is a compilation of information assembled in order to facilitate preparation of a chapter on the same subject for inclusion in a time and frequency handbook. It is based in part on articles prepared for May 1972 issue of PROC IEEE and for May 1971 issue of "On Frequency" by J. A. Barnes.

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# NATIONAL BUREAU OF STANDARDS REPORT

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U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

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THE BASIC CONCEPTS AND MANAGEMENT  
WITHIN THE U.S.A. OF PRECISE TIME AND FREQUENCY

This paper reviews the numerous astronomical time scales, atomic time scales, and compromise time scales. The Universal Time Scales are based on the apparent motion of the sun in the sky, while atomic time scales are based on the periodic fluctuations of a radio signal in resonance with a certain species of atoms. The paper provides not only a description of the organization of the management of time and frequency in the U.S.A., but it also provides in the appendixes copies of the documents which constitute the formal bases of this organization.

Key Words: astronomical time; atomic time; frequency; international atomic time; management; NBS; standard time; time; USNO.

# THE BASIC CONCEPTS AND MANAGEMENT WITHIN THE U.S.A. OF PRECISE TIME AND FREQUENCY

J. A. Barnes

## 1. THE CONCEPTS OF TIME

The measurement of time is a branch of science with a very long history. For this reason it is difficult to understand the current operations of time and frequency measurements without some background. This report presents a brief history of the scientific and engineering aspects of time and frequency measurement, as well as a description of the organization of time and frequency management.

### 1.1. Clocks

In early times, the location of the sun in the sky was the only reliable indication of the time of day. Of course, when the sun was not visible, one was unable to know the time with much precision. People developed devices (called clocks) to interpolate between checks with the sun. The sun was sort of a "master clock" that could be read with the aid of a sundial. An ordinary clock, then, was a device used to interpolate between checks with the sun. The different clock devices form an interesting branch of history but will not be reviewed to any extent here.

Thus, a clock could be a "primary clock" like the position of the sun in the sky, or it could be a secondary clock and only interpolate between checks with the primary clock or time standard. Historically, some people have used the word "clock" with the connotation of a secondary time reference but today this usage would be too restrictive.

### 1.2. Date, Time Interval, and Synchronization

One can use the word "time" in the sense of date. One can also consider the concept of time interval or "length" of time between two events. The difference between these concepts of date and time interval is important and has often been confused in the single word "time". We will have a great deal more to say on this point.

The date of an event on an earth-based time scale is obtained from the number of cycles (and fractions of cycles) of the apparent sun counted from some agreed-upon origin. Similarly, atomic time scales are obtained by counting the cycles of a signal in resonance with certain kinds of atoms. One of the major differences between these two methods is that the cycles of atomic clocks are much, much shorter than the daily cycles of the apparent sun. Thus, the atomic clock requires more sophisticated devices to count cycles than are required to count solar days. The importance of this difference is a matter of technological convenience and is not very profound.

Of technological significance are the facts that atomic clocks can be read with much greater ease and with many thousands of times the precision of the earth clock. In addition the reading of an atomic clock can be predicted with almost 100,000 times better accuracy than the earth clock.

In the U.S. literature on navigation, satellite tracking, and geodesy, the word "epoch" is sometimes used in a similar manner to the word "date". There is considerable ambiguity, however, in the word "epoch" and we prefer the use of the word "date", the precise meaning of which is neither ambiguous nor in conflict with other, more popular uses.

Thus, the date of an event might be: 30 June 1970, 14 h, 35 m, 37.278954 s, UTC, for example, where h, m, s denote hours, minutes, and seconds. (The designation UTC, meaning Universal Time Coordinated, will be discussed below.)

In addition to the concepts of date and time interval, there is the important concept of time synchronization. As an example, two people who wish to communicate with each other might not be critically interested in the date, they just want to be synchronized as to when they use their communications equipment. Many sophisticated electronic navigation

systems (and proposed collision avoidance systems) do not depend on accurate dates but they do depend upon very accurate time synchronization. Even ordinary television receivers require accurate time synchronization.

### 1.3. Time Scales

A system of assigning dates to events is called a time scale. The apparent motion of the sun in the sky constitutes one of the most familiar time scales but is certainly not the only time scale. Note that to completely specify a date using the motion of the sun as a time scale, one must count days (i. e., make a calendar) from some initially agreed-upon beginning. In addition (depending on accuracy needs) one measures the fractions of a day (i. e., "time of day") in hours, minutes, seconds, and maybe even fractions of seconds. That is, one counts cycles (and even fractions of cycles) of the sun's daily apparent motion around the earth.

There are many astronomical time scales and many time scales which can provide precise synchronization. A sensible use of the unqualified word "time" is the use which embodies all of these various aspects of time scales, time measurement, and even time interval (or duration). This is totally consistent with the dictionary definition of the word. Thus, the study of synchronization would be properly said to belong to the broader study of time in general. Thus, it is not only misleading but wrong to say that "time" is only determined by astronomical means. Indeed, there are many classes of time--astronomical time, biological time, and atomic time to name a few.

Time derived from the apparent position of the sun in the sky is called apparent solar time. A sundial can indicate the fractions of cycles (i. e., time of day) directly. Calendars, like the Gregorian Calendar, aid in counting the days and naming them.

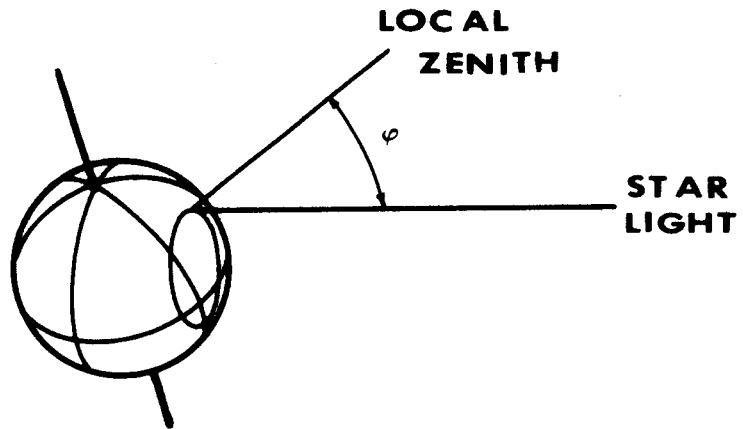
Copernicus gave us the idea that the earth spins on its axis and travels around the sun in a nearly circular orbit. This orbit is not exactly circular, however, and, in fact, the earth travels faster when nearer the sun (perigee) than when further from the sun (apogee). The details of the earth's orbit and Kepler's law of "equal areas" allows one to see that apparent solar time cannot be a uniform time. There is also an effect due to the inclination of the earth's axis to the plane of its orbit (ecliptic plane).

#### 1.4. Universal Time (UT0)

It is possible to calculate these orbital and inclination effects and correct apparent solar time to obtain a more uniform time--commonly called mean solar time. This correction from apparent solar time to mean solar time is called the Equation of Time and can be found engraved on many present-day sundials.

If one considers a distant star instead of our star--the sun--to measure the length of the day, then the earth's elliptic orbit becomes unimportant and can be neglected. This kind of time is the astronomer's sidereal time and is generically equivalent to mean solar time since both are based, ultimately, on the spin of the earth on its axis--the second of sidereal time being just enough different to give a sidereal year one more "day" than that of a solar year. In actual practice, astronomers observe sidereal time and correct it to get mean solar time. Universal Time (UT0) is equivalent to mean solar time as determined at the Greenwich Meridian.

Time, of course, is essential to navigation. In effect, a navigator, using a sextant, measures the angle between some distant star and the navigator's zenith (see fig. 1). It is apparent that for a given star there is a locus of points with the same angle. By sighting on another star, a different locus is possible and obviously the position of the navigator is at one of the intersections of the two loci. (A third sighting can remove



**FIG. 1. CELESTIAL NAVIGATION**

the ambiguity.) The position of this intersection on the earth obviously depends on the earth's rotational position. It is important to emphasize that celestial navigation is basically connected to earth position and only to time because the earth defines a useful time scale.

#### 1.5. UT1

In order for the navigator to use the stars for navigation, he must have a means of knowing the earth's position (i. e., the date on the UT scale). Thus, clocks and sextants became the means by which navigators could determine their locations. With navigation providing a big market for time and for good clocks, better clocks were developed, and these began to reveal a discrepancy in Universal Time measured at different locations. The cause of this was traced to the fact that the earth wobbles on its axis (see fig. 2). In effect, one sees the location of the pole wandering over a range of about 15 meters.

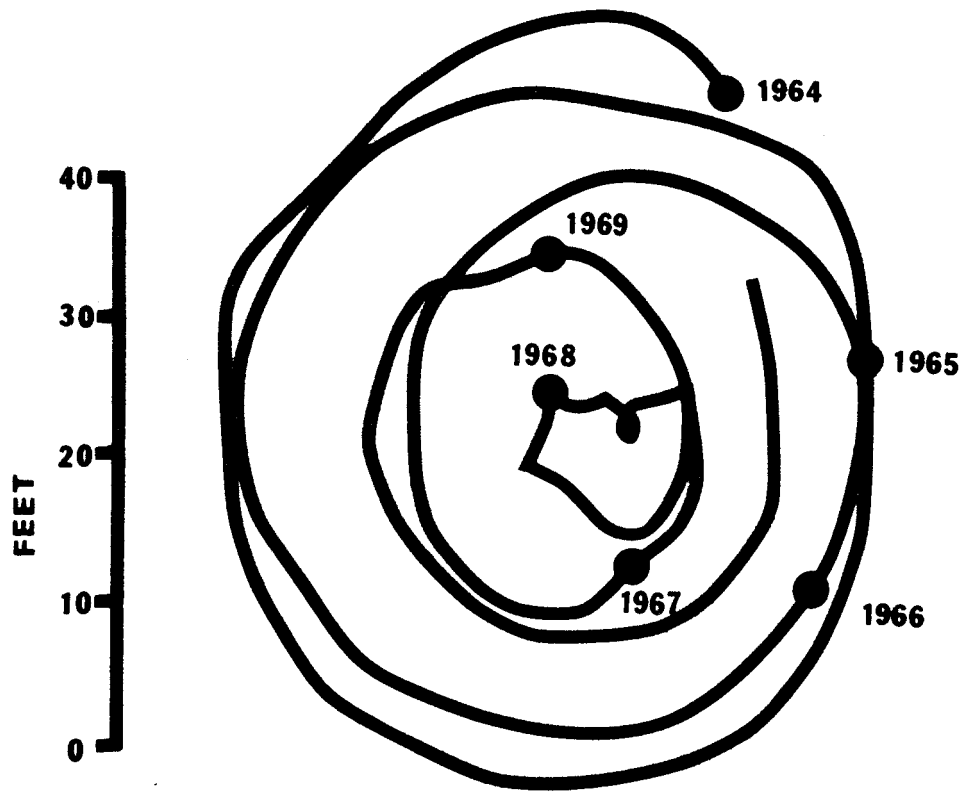
By comparing astronomical measurements made at various observatories spread over the world, one can correct for this effect and obtain a more uniform time--denoted UT1.

#### 1.6. UT2

With the improvement of clocks--both pendulum and quartz crystal--it was discovered several years ago that UT1 had periodic fluctuations (of unknown origin) with periods of one-half year and one year. The natural response was to remove these fluctuations and obtain an even more uniform time--UT2. Thus, there exists a whole family of Universal Times based on the spin of the earth on its axis and various other refinements (see fig. 3).

In this historical progression, one notes that UT1 is the true navigator's scale related to the earth's angular position. UT2 is a smoothed time and does not reflect the real, periodic variations in the earth's angular position. At least in principal, if not in practice, going to UT2 passed by the navigator's needs.





**FIG. 2. PATH OF THE POLE**

# UNIVERSAL TIME FAMILY

APPARENT SOLAR TIME



CORRECTED BY  
EQUATION OF TIME



MEAN SOLAR TIME  
(UT0)



CORRECTED FOR  
MIGRATION OF POLES  
 $\Delta t \sim 0.05\text{sec}$



UT1



CORRECTED FOR  
KNOWN PERIODICITY  
 $\Delta t \sim 0.05\text{sec}$



UT2

Fig. 3.

### 1.7. Ephemeris Time (ET)

At this point it is desirable to go back in time--near the turn of the century--and trace some other astronomical studies. In the latter 19th century, Simon Newcombe compiled a set of tables, based on Newtonian mechanics, which predicted the positions of the sun, the moon, and some planets for the future. A table of this sort is called an ephemeris.

It was discovered that the predicted positions gradually departed from the observed positions in a fashion too significant to be explained either by observational errors or approximations in the theory. It was noted, however, that if the time were somehow in error, all the tables agreed well. At this point it was correctly determined that the rotational rate of the earth was not constant. This was later confirmed with quartz clocks and atomic clocks.

The astronomers natural response to this was, in effect, to use Newcombe's tables for the sun in reverse to determine time--actually what is called Ephemeris Time. Ephemeris Time is determined by the orbital motion of the earth about the sun (not by rotation of the earth about its own axis) and should not be affected by such things as core-mantle slippage or other geometrical changes in the shape of the earth.

### 1.8. Atomic Time (AT)

As it was pointed out above, the date of an event relative to the Universal Time Scale is obtained from the number of cycles (and fractions of cycles) of the apparent sun counted from some agreed-upon origin. (Depending on the need, one may have to apply corrections to obtain UT0, UT1, or UT2.) Similarly, atomic time scales are obtained by counting the cycles of a signal in resonance with certain kinds of atoms.

In the latter part of the 1940's, Harold Lyons at the National Bureau of Standards announced the first Atomic Clock. In the mid-1950's several laboratories began atomic time scales.

The Bureau International de l'Heure (BIH) has been maintaining atomic time for some years now, and this time scale received the official recognition of the General Conference of Weights and Measures (CGPM) in October 1971 (see Appendix A). Beginning 1 January 1972 this atomic time scale has been broadcast (with some modifications) by most countries (see "The New UTC System" below).

In review, we have discussed three broad classes of time scales (see fig. 4):

The Universal Time family is dependent on the earth's spin on its axis; Ephemeris Time depends on the orbital motion of the earth about the sun; and Atomic Time, which depends on a fundamental property of atoms, is very uniform and precise. Because of the "slow" orbital motion of the earth (one cycle per year), measurement uncertainties limit the realization of accurate ephemeris time to about 0.05 second for a 9-year average, while UT can be determined to a few thousandths of a second in a day, and AT to a few billionths of a second in a minute or less.

#### 1.9. Coordinated Universal Time (UTC) Prior to 1972

From 1958 through 1971 most broadcast time signals (e.g., WWV) were based on a time scale called Coordinated Universal Time (UTC). The rate of a UTC clock was controlled by atomic clocks to be as uniform as possible for one year, but this rate could be changed at the first of a calendar year. The yearly rate was chosen by the BIH. Table I lists the fractional offsets in rate of the UTC scale relative to a pure atomic time scale.

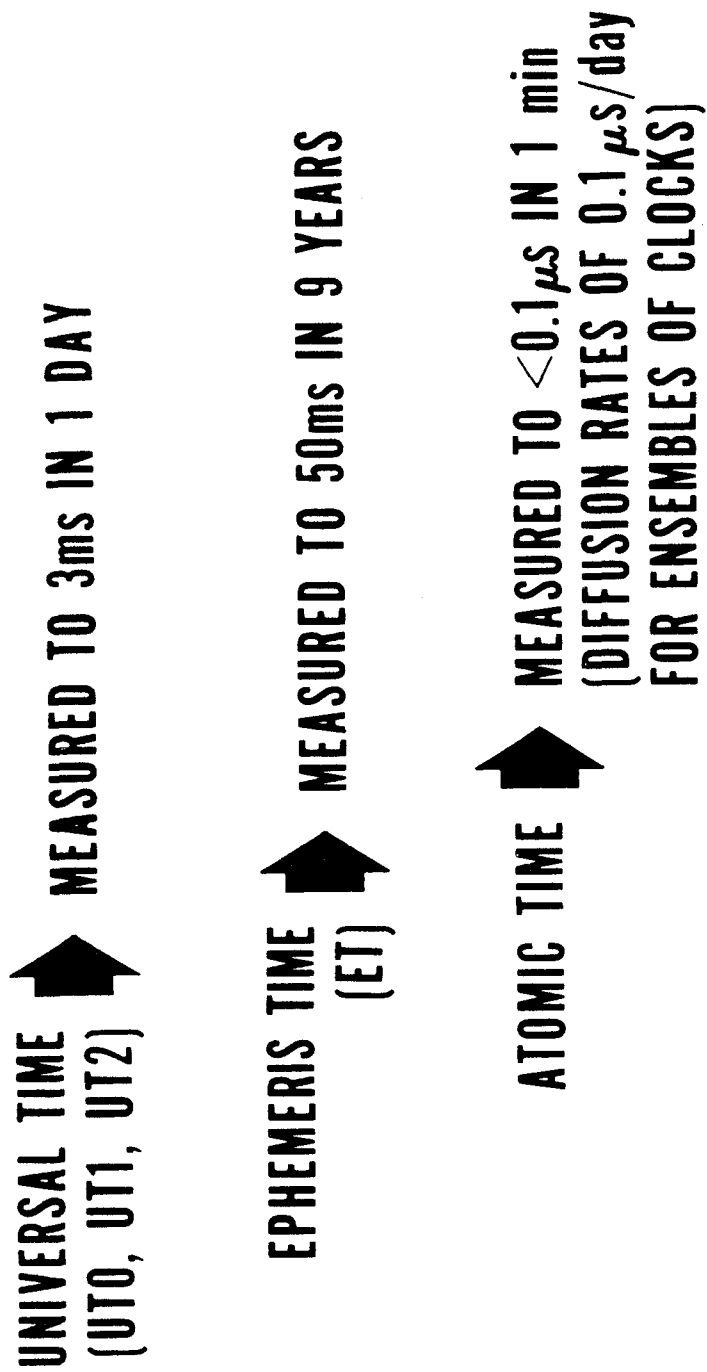


Fig. 4.

Table I

<u>Year</u>	<u>Offset rate of UTC in parts per <math>10^{10}</math></u>
1960	- 150
1961	- 150
1962	- 130
1963	- 130
1964	- 150
1965	- 150
1966	- 300
1967	- 300
1968	- 300
1969	- 300
1970	- 300
1971	- 300
1972 (and for the future)	0

The minus sign implies that the UTC clock ran slow (in rate) relative to atomic time.

The offset in clock rate was chosen to keep the UTC clock in reasonable agreement with UT2. However, one could not exactly predict the earth's rotational rate and discrepancies would accrue. By international agreement, UTC was supposed to agree with UT2 to within 1/10 second (1/20 second before 1963). On occasion it was necessary to reset the UTC clock by 1/10 second (1/20 second before 1963) in order to stay within the specified tolerances (see fig. 5).

Also, by international agreement, the offsets in clock rate were constrained to be an integral multiple of 5 parts per billion (1 part per billion before 1964).

Also, a few stations (e.g., WWVB) broadcast a Stepped Atomic Time (SAT) signal which was derived directly from an atomic clock (no rate offset) but which was reset periodically (more often than UTC) to maintain SAT within about 1/10 second of UT2.

COORDINATED UNIVERSAL TIME (UTC) (1958 to 1971)

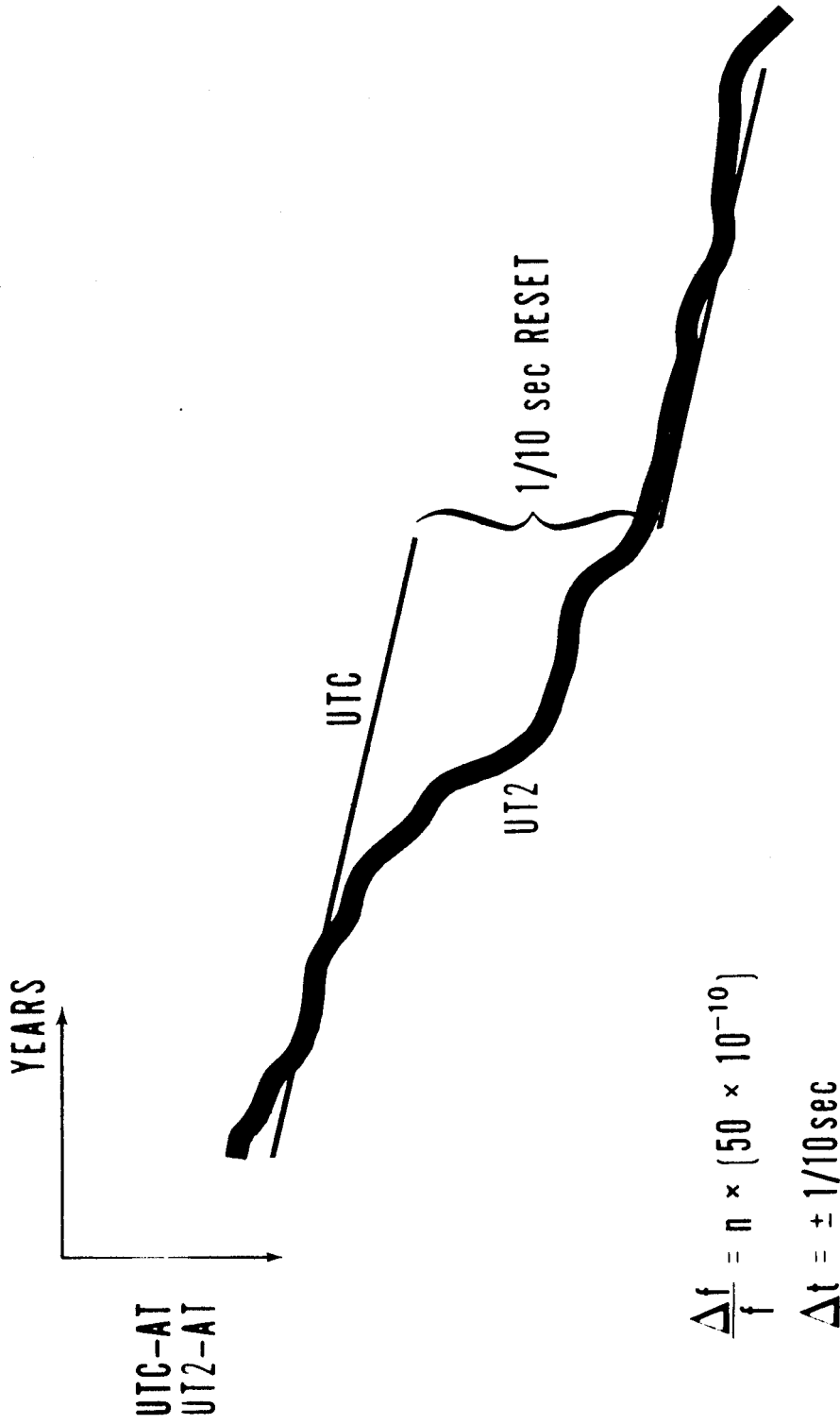


Fig. 5.

### 1.10. The New UTC System

The facts that the clock rate of UTC have been offset (see Table I) from the correct (atomic) rate and that this offset changed from time to time necessitated actual changes in equipment and often even the interruption of sophisticated systems. As the needs for reliable synchronization have increased, the old UTC system became too cumbersome. A new compromise system was needed to account better for the ever-growing needs of precise time synchronization.

The new UTC system was adopted by the International Radio Consultative Committee (CCIR) in Geneva in February 1971 and became effective 1 January 1972 (see Appendix B). In this new system all clocks run at the correct rate (zero offset). This leaves us in a position of having the clock rate not exactly commensurate with the length of the day. This situation is not unique:

The length of the year is not an exact integral multiple of the day. This is the origin of "leap year". In this case, years which are divisible by 4 have an extra day--February 29--unless they are also divisible by 100, and then only if they are not divisible by 400. Thus, the years 1968, 1972, 1976, and 2000 are leap years. The year 2100 will not be a leap year. By this means our calendar does not get out of step with the seasons.

With this as an example, it is possible to keep the clocks in approximate step with the sun by the infrequent addition (or deletion) of a second--called a "leap second". Thus, there may be special situations where a "minute" contains 61 (or 59) seconds instead of the conventional 60 seconds. This should not occur more often than about once a year. By international agreement, UTC will be maintained within 0.7 second of the navigators' time scale, UT1. The introduction of leap seconds allows a good clock to keep approximate step with the sun. Because of the variations in the rate of rotation of the earth, the occurrences of the leap seconds are not predictable in detail.



### 1.11. Comparisons of Time Scale Uniformity

One can imagine synchronizing a clock with a hypothetically ideal time scale. Some time after this synchronization our confidence in the clock reading has deteriorated. Figure 6 shows the results of some statistical studies which indicate the probable errors of some important clocks after synchronization. There are really two things of significance to note in fig. 6: First, Atomic Time (state of the art, 1964) is almost 10,000 times more uniform than Universal Time, and second, measurement uncertainty totally limits any knowledge of statistical fluctuations in Ephemeris Time.

### 1.12. Astronomical Time and International Atomic Time (IAT)

The astronomical time scales have an advantage that a single "clock" is available to everyone (since there has been only one solar system available for us to study). The atomic clock in a laboratory might or might not be available to others and, since more than one can easily exist, there is the possibility of disagreements which are not possible when one has only one clock. It might seem that the continued motion of the solar system is much more reliable than the continued operation of atomic clocks. Thus, atomic clocks must be made highly reliable to compete at all with astronomical time scales.

For an international atomic time scale to be of value, it must possess the following attributes:

1. It must provide greater accuracy and convenience than the astronomical counterparts.
2. It must be highly reliable with almost no chance of a failure of the clock system. (This can be accomplished by using many clocks dispersed over the world but which can be intercompared accurately.)
3. The atomic time scale must be readily available everywhere.

# PROBABLE CLOCK ERRORS (NON-UNIFORMITY)

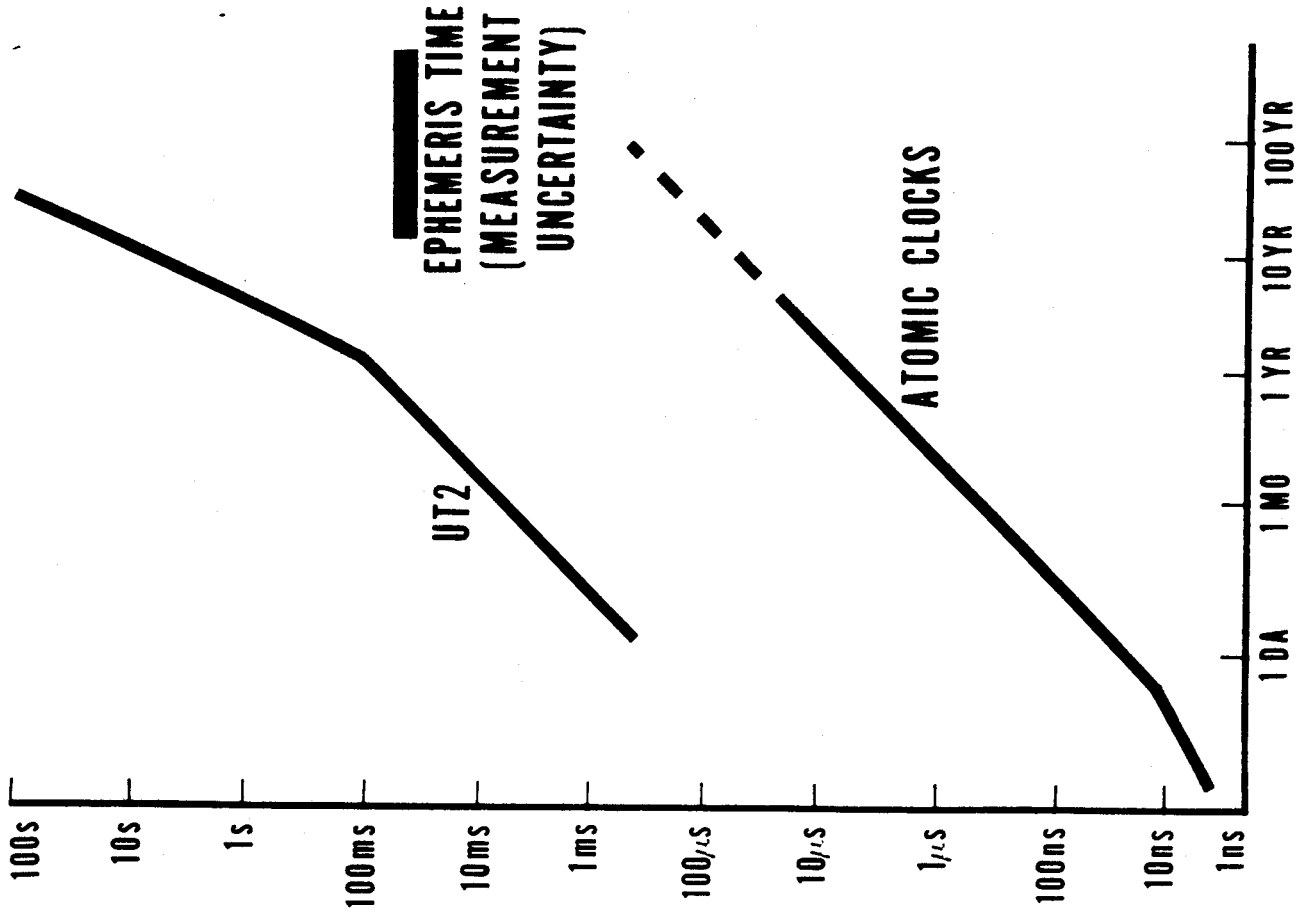


Fig. 6.

Indeed, all of these points appear to be more than adequately covered by the atomic time scale of the BIH. The General Conference of Weights and Measures (CGPM) has endorsed the BIH atomic time scale as the International Atomic Time scale. Yet, even with the existence of an International Atomic Time scale, one must recognize that there will be continued need for the astronomical time scales. A person doing celestial navigation, for example, must know earth position (UT1).

## 2. THE CONCEPTS OF FREQUENCY AND TIME INTERVAL

The four independent base units of measurement currently used in science are length, mass, time, and temperature. It is true that, except for fields of science such as cosmology, geology, and astronomy, time interval is the most important concept, and (astronomical) date is of much less importance to the rest of science. This is true because the "basic laws" of physics are differential in nature and only involve small time intervals. In essence, physical "laws" do not depend upon when (i. e., date) they are applied.

Based on these laws and extensive experimentation, scientists have been able to demonstrate that frequency can be controlled and measured with the smallest percentage error of any physical quantity. Since most clocks depend upon some periodic phenomenon (e. g., a pendulum) in order to "keep time", and since one can make reliable electronic counters to count the "swings" of the periodic phenomenon, we can construct clocks with timekeeping accuracy equal to the accuracy of the frequency standard.

In terms of the history of time scales, the history of the definition of the second can be expressed very briefly. Prior to 1956, the second was defined as the fraction  $1/(86,400)$  of a mean solar day. From 1956 to 1967 it was the ephemeris second defined as the fraction  $1/(31\,556\,925.9747)$  of the tropical year at 00 h 00 m 00 s 31 December 1899, and since 1967, in terms of a resonance of the cesium atom.

In fact, the present international definition of the second (unit of time interval) is based on the resonance frequency of the cesium atom (see Appendix A). The present definition of the second states:

"The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom (13th CGPM (1967), Resolution 1)."

Today's most precise and accurate clocks incorporate a cesium atomic beam as the "pendulum" of the clock.

### 2.1. Time Interval and Time Scales

We should note sources of confusion which exist today in the measurement of time and in the use of the word "second". Suppose that two events occurred at two different dates. For example the dates of these two events were 15 December 1970, 15 h 30 m 00.000000 s UTC and 15 December 1970, 16 h 30 m 00.000000 s UTC. At first thought one would say that the time interval between these two events was exactly 1 hour = 3600.000000 seconds, but this is not true. (The actual interval was longer by about 0.000108 seconds [ $3600 \text{ seconds} \times 300 \times 10^{-10}$ ]. See Table I.) Recall that the UTC time scale (like all the UT scales and the ET scale) was not defined in accordance with the definition of the interval of time, the second. Thus, one cannot simply subtract the dates of two events as assigned by the UTC scale (or any UT scale or the ET scale) in order to obtain the precise time interval between these events. Historically, the reason behind this state of affairs is that navigators need to know the earth's position (i. e., UT1)-~~not~~ not the duration of the second. Yet, many scientists need to know an exact and reproducible time interval. Note that this might also be true of the new UTC system if the particular time interval included one or more leap seconds.

It is also confusing that the dates assigned by the UT, ET, and UTC scales involve the same word as the unit of time interval, the second. For accurate and precise measurements, this distinction can be extremely important.

### 3. USES OF TIME SCALES

The study of time can be divided into the study of time scales used for systems synchronizations and time scales used for celestial navigation and astronomy.

#### 3.1. Time Scales for Systems Synchronization Uses

Long ago people were simply content to let the sun govern their lives. When the sun came up it was time to begin work; when the sun set it was time to stop.

With the growth of commerce and city life and the advancement of technology, a community could have its own clock set to agree roughly with the sun. Thus developed the idea of local time and each community could have its own local time. Clearly, when almost all dealings and communications take place within a given community this is a workable solution.

With the advent of railroads and hence more rapid communications, this "crazy-quilt" maze of individual local times had to come to an end. The railroads are generally credited with unifying the various local times into time zones which have presented a much more workable national time system.

What one sees clearly in this historical sequence is that, as communications become more rapid and more far-reaching, the greater are the demands on an all-pervasive and unifying convention of synchronizing clocks with each other. That is, this convention is a matter of convenience and there is nothing sacred or absolute about what our clocks read; it's just important that they read the same time (or have a well-defined time difference as between the time zones).

In the days when the railroads were the primary means of transportation across the North American continent, an accuracy of a few seconds of time was important and sufficient. Nowadays, with the existence of sophisticated telecommunications equipment capable of sending and receiving several million alphanumeric characters each second, there are real needs for clock synchronizations at accuracy levels of a millionth of a second and better.

### 3.2. Time Scales for Celestial Navigation and Astronomical Uses

As pointed out above, time is essential for celestial navigation. Basically, the reason is something like this: If one knows what time it is (i. e., solar time) at some reference point--say the Greenwich Meridian--and one also knows his local time--say from a sundial--one can figure his longitude simply by remembering that the earth makes one complete revolution on its axis in about 24 hours.

For example, noon Greenwich Mean Time is 2 a. m. Hawaiian Standard Time or 10 hours different. Thus, it's easy to calculate that Hawaii is about 10/24 of the way around the world from Greenwich, England--in other words about  $150^{\circ}$  west of the Prime Meridian.

If this person were to measure the actual position of the sun in the sky using, say, a navigator's sextant, then he could get a rather accurate determination of local solar time. The problem, then, would be to know the correct time on the Greenwich Meridian.

Back about 200 years ago, a man in England named Harrison was awarded £20,000 for building a chronometer which would allow the accurate determination of longitude while at sea. Until radio made its appearance, navigation at sea was totally dependent upon good clocks.

Nowadays, there are many standard time broadcast stations in the world. Two of the best known standard time broadcast stations are operated by the National Bureau of Standards: One is WWV located in

Fort Collins, Colorado, and the other is WWVH now located on the west coast of the island of Kauai, Hawaii.

If astronomical time could be measured with sufficient accuracy and convenience, then astronomical time could be used for the systems synchronization uses also. In actuality, astronomical time is difficult to measure, and accuracies of a few milliseconds may be realized only after a whole evening's sightings are averaged by a sophisticated and well-equipped observatory.

### 3.3. Compromise Time Scales

Two very different uses for time have been discussed. The first was a convention which, when universally accepted, allows very high speed and efficient communications systems to function. The needs here are for extremely precise and uniform measurements of time. The second use was for celestial navigation and astronomy. Here there is no need for highly precise time, at least not to the same degree as the first mentioned use.

Because of the conflicting requirements imposed on time scales by these two categories of time scale users, there has been a great deal of effort to obtain a compromise time scale which adequately reflects the relative importance of these two user groups. As one might well imagine, with the growing importance and sophistication of communications systems and the implementation of electronic navigation systems (to replace celestial navigation), the trend in the compromise time scales has been away from time scales based on the earth's rotation (i. e., astronomical time scales) and toward a pure atomic time scale.

We find ourselves in a rather familiar situation. There is not a whole number of days in the year and we don't want the calendar to get badly out of step with the seasons. Similarly, there is not a whole number of seconds in a solar day and we don't want our clocks to get badly out of step with the sun. The solution (as noted above) is analogous--like the leap year with its extra day, we have an extra second--a leap second (see Appendix B).

#### 4. THE ORGANIZATION OF TIME AND FREQUENCY MANAGEMENT IN THE U.S.A.

During the past few years, the organization of time and frequency management in the U.S.A. has not changed dramatically. Since this organization is rather stable, it is reasonable to present here a statement of the present organization without much historical discussion of its evolution. It is intended in this section not only to provide a description of the organization but also to provide in the appendixes the formal documents which form the formal bases of this organization.

##### 4.1. Time and Frequency Activities of the National Bureau of Standards

In Title 15 of the United States Code, §272, it states (see Appendix C): "Sec. 2. The Secretary of Commerce is authorized to undertake the following functions:

"(a) The custody, maintenance, and development of the national standards of measurement, and the provisions of means and methods for making measurement consistent with those standards, including the comparison of standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government."

In Department of Commerce Order, DO 30-2A (October 1, 1968), the above authority is delegated to the Director of the National Bureau of Standards (see Appendix C).

In response to this state of affairs, there is a Time and Frequency Division within the National Bureau of Standards.

Within this Division (see fig. 7) there is a Section (273.04) devoted to the operation of the NBS standard of frequency and time interval and the operation of several time scales based upon it. Also within this Section is located the research and development effort of the NBS to improve the primary frequency standard and the associated time scales.



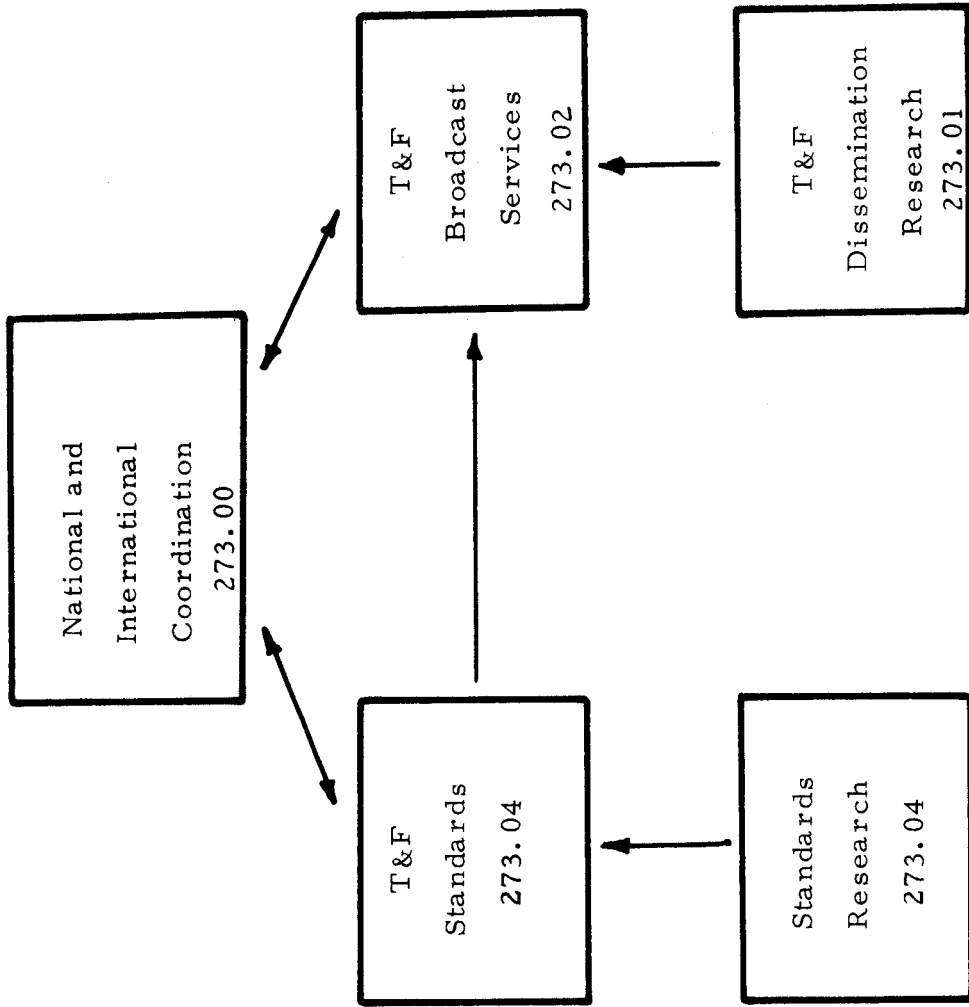


Fig. 7. The Time and Frequency Division of the NBS

Thus, this Section can fairly be said to have the responsibilities of "custody, maintenance, and development of the national standards" of frequency and time interval. (The definition of "standard time" involves certain legal aspects. See Section 7.)

There is a Section (273.02) which disseminates the standard frequencies and the time scales of Section 273.04 via radio (WWV, WWVH, and WWVB) and via telephone (303-499-7111). More detailed information may be obtained by requesting Special Publication 236 from:

Time and Frequency Broadcast Services Section  
National Bureau of Standards  
Boulder, Colorado 80302.

Within the Time and Frequency Division there is a Section (273.01) which conducts research and development activities on new methods of disseminating time and frequency information. As examples, this Section developed the TV line-10 synchronization pulse technique [1] based on the work of Tolman, et al. [2]; and this Section devised and perfected a more extensive TV time system [3] which actively encodes time signals in the vertical interval.

All of the activities of these Sections are coordinated both nationally and internationally through the Time and Frequency Division Office (273.00).

In a formal sense, the mission of the Division and the individual Sections are summarized in the following official functional statements:

Time and Frequency Division (273.00): Develops and maintains frequency and time interval standards and time scales. Conducts fundamental and applied research to establish such standards. Disseminates internationally coordinated frequency and time through radio broadcasts, portable clocks, and other advanced techniques. Engages in research and development on new dissemination techniques that improve accuracy and increase coverage. Develops improved instrumentation for dissemination of time and frequency. Coordinates time

and frequency nationally and internationally. Conducts fundamental physical research in which the techniques used in time and frequency standards are of critical importance. Disseminates information through consultation and publication."

"Frequency-Time Dissemination Research Section (273.01):

Conducts research and development on new and improved methods of dissemination of frequency and time standards including satellites, very low frequency (VLF), portable clocks, and other advanced techniques; investigates propagation errors of time signals, provides consultation on methods of frequency and time dissemination; compares and evaluates methods of frequency and time dissemination; and makes recommendations for improvements in monitoring techniques and other mission components."

"Frequency-Time Broadcast Services Section (273.02): Provides wide dissemination of frequency and time standards primarily by radio broadcasts; investigates and develops techniques for improving the accuracy with which frequency and time can be distributed by broadcasting electromagnetic signals; measures distortion involved in the radio broadcast of time and frequency standards, particularly with regard to electronic transmitting and receiving equipment; provides consultation relative to the frequency and time broadcast services; evaluates the effectiveness of the frequency and time broadcast services; recommends improvement or modification of existing services or additions of new services; and monitors frequency and time broadcasts from various sources."

"Atomic Frequency and Time Standards Section (273.04):

Provides atomic frequency standards for the United States and develops and improves such standards. Provides, develops, and improves atomic time scales based on the frequency standards, and evaluates such time scales for consideration as a standard. Pursues fundamental

research where needed to execute the foregoing. Furnishes time and frequency signals to other sections of the division. Performs frequency and time calibration services for science, industry, commerce, and government users who require reference to the national standard."

#### 4.2. Time and Frequency Activities of the U. S. Naval Observatory

The U. S. Naval Observatory is administratively located in the office of the Assistant Vice Chief of Naval Operations within the Office of the Chief of Naval Operations in the Department of the Navy within the Department of Defense. The Naval Observatory was first transferred to the Office of the Chief of Naval Operations by Executive Order 9126, April 8, 1942. This was formalized 4 years later in Reorganization Plan No. 3 of 1946 (see Appendix D).

From the official statement of the Mission and Functions of the U. S. Naval Observatory (see Appendix E), the following function is the primary responsibility of the Time Service Division:

"5. Derive, maintain, and coordinate precise time and time interval (frequency), both astronomical and atomic, for the Department of Defense; and control distribution of, and provide single management service and inter-service support for precise time and time interval within the Department of Defense."

In addition to the Time Service Division, within the U. S. Naval Observatory there are

- (1) The Seven-inch Transit Circle Division;
- (2) The Nautical Almanac Office;
- (3) The Astrometry and Astrophysics Division; and
- (4) The Six-inch Transit Circle Division.

For this report the Time Service Division is of primary concern. For the remainder of this report, reference to the U. S. Naval Observatory (USNO) will essentially involve only the activities of the Time Service Division.

The authority of the USNO within DoD relative to matters of precise time and time interval (PTTI) are spelled out in DoD Directive 5160.51, August 31, 1971 [4] (see Appendix F). This directive supersedes and replaces the following documents:

DoD Directive 5160.51, February 1, 1965; and

DoD Instruction 4630.4, June 22, 1966.

The new DoD Directive 5160.51 explicitly assigns the responsibility to the USNO of being the central reference point within DoD for PTTI matters.

The primary activities of the Time Service Division of the USNO can be summarized as follows:

(1) Control of Time and Time Interval Section

Provides the distribution and publication of time service announcements and the control information of stations (e.g., Loran C) which are controlled by the USNO.

(2) Precise Time Operations Section

This Section is actively involved in portable clock transportation for time dissemination and in general liaison activities, chiefly within DoD.

(3) The Astronomical Sections (Washington and Richmond)

Includes the determination of Universal Time (UT) using Photographic Zenith Tubes (PZT). Similar measurements made by other national observatories at various places around the world are essential for the determination of the time scale UT1--the true navigator's time scale. Since UT1 incorporates corrections for the migration of the poles and these corrections can (at present) only be determined by combining several observations made at various observatories distributed over the world, the final values of UT1 (usually expressed as a difference from the compromise time scale, UTC) are

determined by the International Time Bureau (BIH) in Paris. The final BIH values of UT1 are based on the observations of about 75 different observatories [5].

The USNO operates PZT's in Washington, D.C., and Richmond, Florida. The Richmond section also undertakes activities similar to those of the entire Time Service Division including portable clock efforts.

Of course, one of the main activities of the USNO Time Service Division is the operation of an atomic time scale system. Occasionally dozens of commercial atomic clocks are available for the scale, but about 16 are normally used [6], [7].

#### 4.3. The Time and Frequency Roles of NBS and USNO Contrasted

Based on Sections 4.1 and 4.2, some of the key activities of the NBS and the USNO are summarized in Table II. Exclusive or primary responsibilities within the U.S.A. are noted in the table.

Currently, the NBS and USNO time scales UTC(NBS) and UTC(USNO) are coordinated to within a tolerance of  $\pm 5$  microseconds (see Appendix G). Figure 8 summarizes the primary interactions of the NBS and USNO. (The percentage figures indicated on fig. 8 arise from the relative weights assigned by the BIH to the U. S. contributions to the various time scales. See Ref. [5].)

## Table II

### T&F Functions of the NBS and USNO

#### Present System

##### NBS (Time and Frequency Division)

- \* National Standards of Measurement (Frequency and Time Interval)
- \* Accurate Frequency and Time Interval
- \* General Public Stable Clock Reference
- DoD Stable Clock Reference (PTTI Ref. Std.) (see Appendix G)
- Coordinate Time Scales
- General Consultation and Education
- Fundamental Research

##### USNO (Time Service Division)

- \* Publish UT Information
  - \* DoD Authority on PTTI
  - \* Worldwide Time Service for DoD
  - Coordinate Time Scales
  - General Consultation
- \* Exclusive or primary responsibility

#### 4.4. The Composite System

It is possible to suppress some of the detail which has been discussed up to this point and more clearly display how the system interacts with the users and the International Time Bureau (BIH). Figure 9 summarizes these interactions.

Astronomical time as determined in the U.S. (actually by the USNO) provides an input ( $\sim 1\%$  to  $2\%$ ) to the definitive values of the various Universal Time (UT) scales as announced by the BIH [5].

The Atomic Time (AT) scales maintained in the U.S. (by both the NBS and the USNO) constitute about  $37\frac{1}{2}\%$  of the stable reference information used in maintaining a stable International Atomic Time (IAT) scale by the BIH [5].

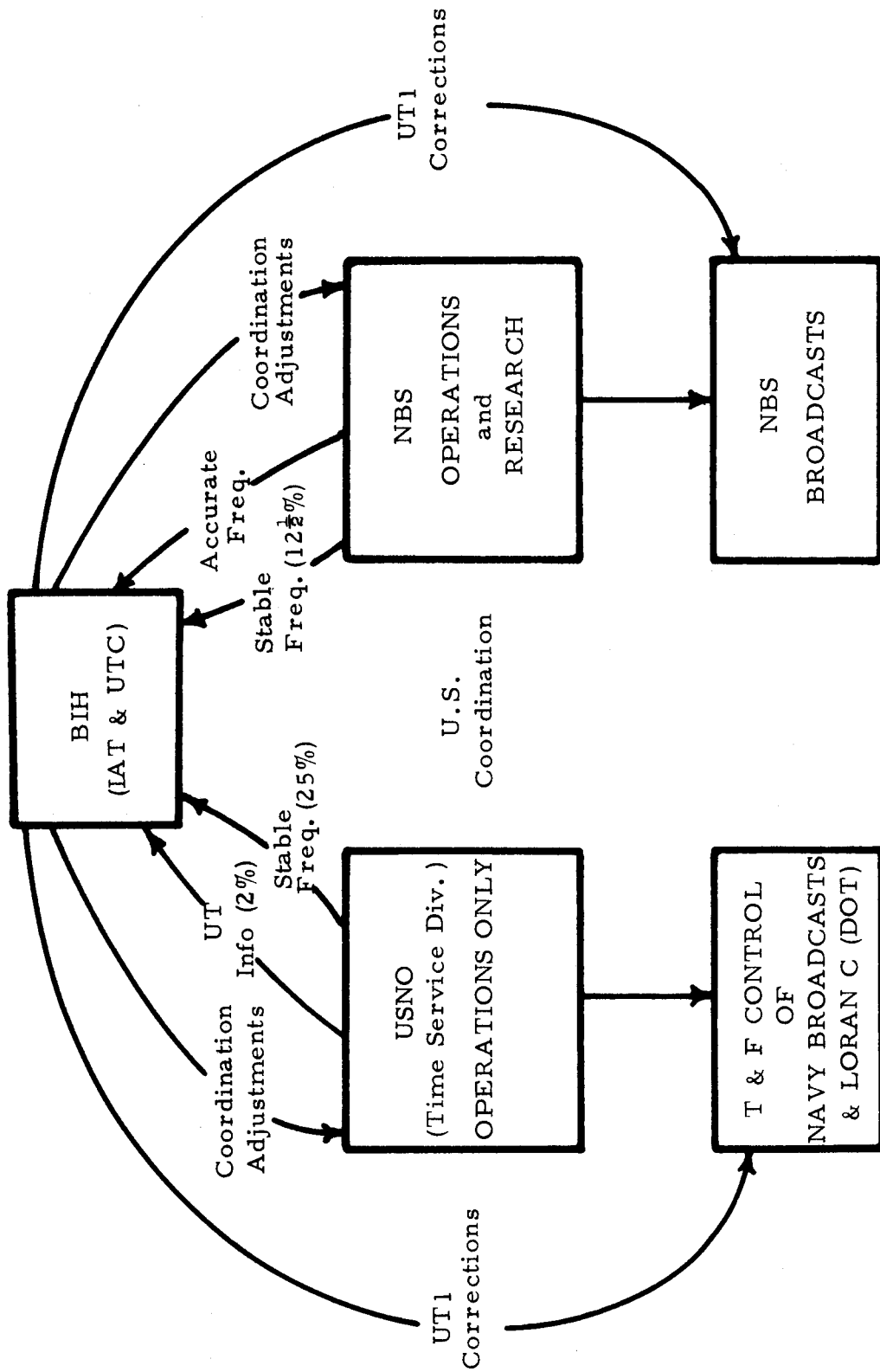


Fig. 8. NBS and USNO Interactions



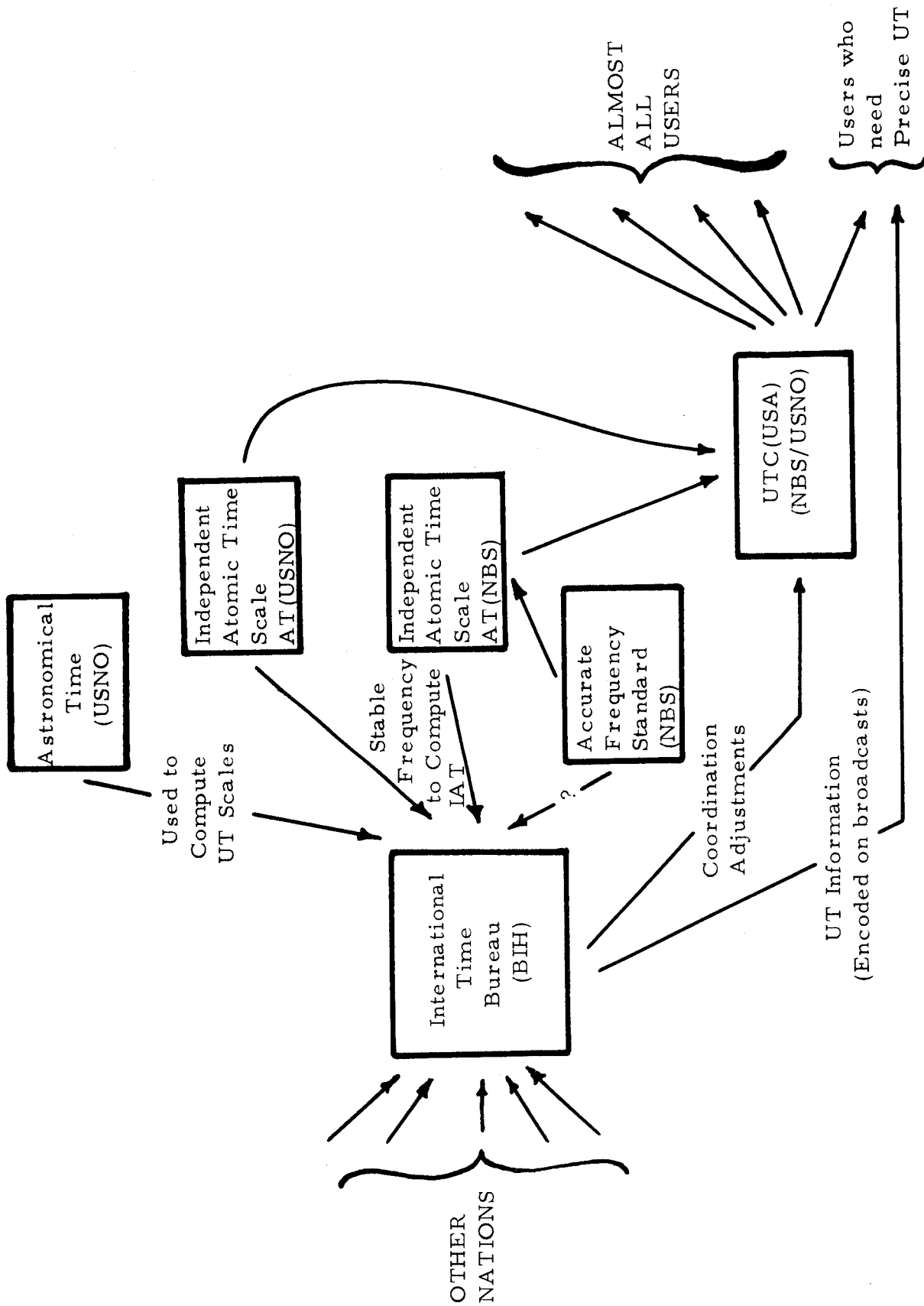


Fig. 9. The Composite System of Time Scale Coordination in the U.S.A.

The question of accuracy of rate of the IAT scale is not totally determined at this point in time [8]. As far as accurate frequency information is concerned, the NBS provides the (almost) unique U.S. input to accuracy (the overall average of commercial frequency standards may contribute something). Since no formal averaging procedure yet exists (see Appendix A) for correcting IAT, we cannot make many definitive statements about the U.S. contributions here.

The UTC scales of the U.S.A. are derived from a coordinated atomic time scale by incorporating the coordination adjustments announced by the BIH (see Appendix B). All of the UTC scales are to agree with UTC(BIH) to within  $\pm 1$  millisecond by International Radio Consultative Committee (CCIR) agreement.

For those needing more accurate UT information, corrections are encoded into standard time broadcasts. These corrections are those announced by the BIH (see Appendix B).

## 5. INTERNATIONAL ORGANIZATIONS INVOLVED IN STANDARD TIME AND FREQUENCY

It is easy to see that the general subject of time and frequency is important in three fundamentally different ways. First, it is important as one of the four independent base units in metrology (i. e., length, mass, time, and temperature); that is, it is important to the International System (SI) of units of measurement. Second, time and frequency are important scientifically in their own right, not just as they influence measurements; and third, the methods of dissemination of standard time and frequency are important from a regulatory aspect such as the assignment of radio spectrum for broadcast purposes of standard time and frequency.

### 5.1. International Organizations

One can find three separate chains of international involvement with time and frequency (see fig. 10) corresponding to the above-noted aspects:

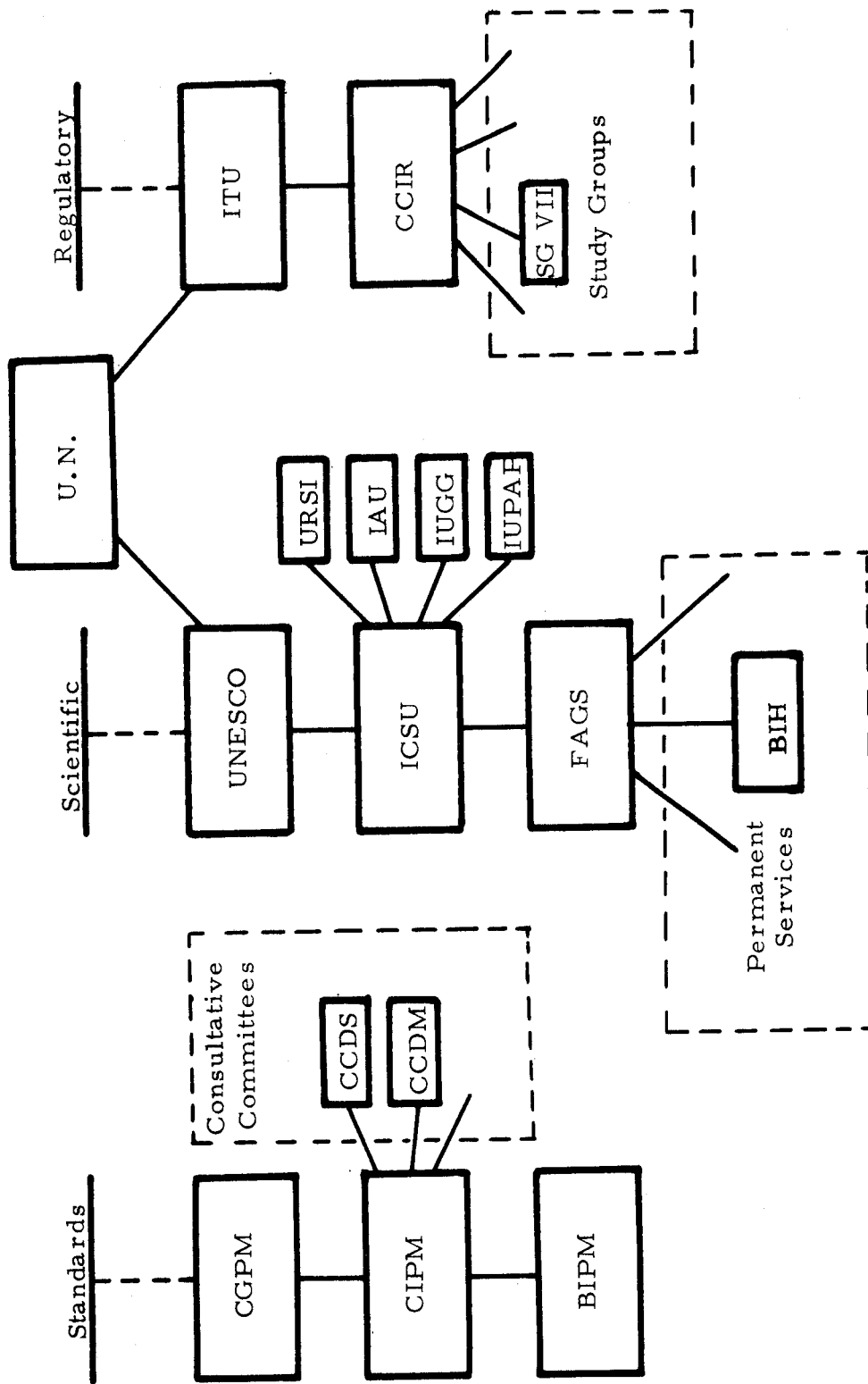


Fig. 10. International Organizations Involved with Standard Frequency and Time

(a) Organizations of the Treaty of the Meter (Standards)

The U.S.A. was one of the original signers of the Treaty of the Meter in 1875 (see Appendix H). This treaty established an international standards laboratory (Bureau International des Poids et Mesures, BIPM) which is governed by an international committee (Committee International des Poids et Mesures, CIPM) composed of representatives of the member nations. Advisory to the CIPM are various technical consultative committees (e.g., the Consultative Committee for the Definition of the Second, CCDS; the Consultative Committee for the Definition of the Meter, CCDM; etc.).

Policy decisions such as financial assessments of the member nations and final endorsements of new definitions of standards are handled by a General Conference of Weights and Measures (CGPM).

(b) Some Organizations under UNESCO (Scientific)

Under the direction and financial support of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) there is the International Council of Scientific Unions (ICSU). There are four Scientific Unions (see Table III for abbreviations): URSI, IAU, IUPAP, and IUGG. Within these scientific unions, time and frequency matters are primarily confined to URSI Com I and IAU Com 4 and 31.

ICSU has established a number of permanent services administered by the Federation of Astronomical and Geophysical Services (FAGS). These permanent services include the Bureau International de l'Heure (BIH), the International Polar Motion Service, and others.

Historically, the BIH has had the responsibility of coordinating and calculating the final and formally adopted measurements of astronomical time. With the advent of atomic clocks the BIH

UN	United Nations
CGPM	General Conference of Weights and Measures
CIPM	International Committee of Weights and Measures
CCDS	Consultative Committee for the Definition of the Second
CCDM	Consultative Committee for the Definition of the Meter
ITU	International Telecommunications Union
UNESCO	United Nations Educational, Scientific, and Cultural Organization
CCIR	International Radio Consultative Committee
ICSU	International Council of Scientific Unions
IAU	International Astronomical Union
IUPAP	International Union of Pure and Applied Physics
IUGG	International Union of Geodesy and Geophysics
URSI	International Scientific Radio Union
FAGS	Federation of Astronomical and Geophysical Services
BIH	International Bureau of Time
BIPM	International Bureau of Weights and Measures

Table III

Abbreviations of International Organizations

established its own atomic time scale (IAT) which is based, ultimately, on a weighted average of various national time scales. The CGPM has endorsed the IAT scale as defining International Atomic Time (date) and the CGPM will provide some financial assistance to the BIH.

(c) International Radio Consultative Committee (CCIR) (Regulatory)

Advisory to the International Telecommunications Union (ITU) is the CCIR with its numerous Study Groups. Study Group 7 of the CCIR is concerned with standard frequency and time broadcasts.

The recommendations of CCIR specify the acceptable formats for the standard frequency and time broadcasts as well as the tolerances of the broadcast scales relative to the time scales of the BIH (see Appendix B). Although these recommendations do not have the force of international law, almost all countries carefully adhere to them.

For each of the international organizations cited above there exists either national delegates or national committees which try to formulate the national policy to be presented to the international organizations.

## 6. SUMMARY STATEMENT OF THE ROLES OF THE USNO, NBS, AND BIH IN TIME AND FREQUENCY

Within the United States there are two primary organizations actively distributing accurate and precise time and frequency. These two organizations are the U. S. Naval Observatory (USNO) in the Department of Defense (DoD)(see Appendixes E & F) and the National Bureau of Standards (NBS) in the Department of Commerce (DoC) (see Appendix C).

From the previous discussions, one sees that the USNO Time Service Division is primarily an operational organization with primary responsibility to DoD. The NBS, on the other hand, has both operational and research aspects to its time and frequency program and is the single governmental organization responsible for the "custody, maintenance, and development of the national standards of measurement... with the standards adopted or recognized by the government." (See Appendix C.)

Within the DoD, there is an understandable need for a single time reference point (see Appendix F). This is provided by the USNO. For various reasons, the DoD has need of a highly uniform atomic time scale. This is currently accomplished at the USNO with an ensemble of (~ 16) commercial cesium beams.

The NBS has legal responsibility (see Appendix C) to develop and document the absolute accuracy of its frequency standards and to disseminate the standard frequency and time to the general public.

Thus, it is reasonable to summarize with the following statement: The USNO has the responsibilities of determining the U.S. input to the BIH for astronomical time (date) and of providing a central time reference point for the DoD, while the NBS is responsible for the "custody, maintenance, and development of the national standards" of frequency and time (interval) as well as their dissemination to the general public. The BIH, on the other hand, has the responsibilities of determining the definitive values of Universal Time (date), International Atomic Time (date), and Coordinated Universal Time (date).

## 7. THE LEGAL DEFINITION OF STANDARD TIME

The legal basis of Standard Time in the U.S.A. is contained in the "Uniform Time Act of 1966" and Public Law 89-387 (see Appendix I).

It is significant to note that Standard Time of the various U.S. zones is based on mean solar time of the specified longitudes. There is no statement in the law as to who or which organization is responsible for assigning dates to events relative to this scale or who or what organization (if any) is responsible for distributing "Standard Time". It does specify the Department of Transportation (DoT) as the agency responsible for enforcing the law.

Mean solar time (related to UT0 not UT1) is simply apparent solar time (what a sundial reads plus day number), corrected for the effects of orbital eccentricity and the tilt of the earth's axis relative to the ecliptic plane--i.e., corrected by the "equation of time".

Since a date of an arbitrary event relative to the mean solar time scale has an uncertainty of no less than about 1 millisecond, Standard Time per se cannot possibly satisfy many of the needs for precise (and convenient) synchronizations.

Further, from conversations with the Assistant General Counsel for Regulations of the Department of Transportation, we understand that DoT would not, in general, attempt to enforce the law provided compliance to the law was within, say, about 5 minutes. An error of greater than several minutes would be interpreted as an intent to avoid the law. Thus, a sundial, a table of "the equation of time", and the local correction from the reference longitude, should be more than adequate for the determination of Standard Time within the presently enforced limits of the law.



It appears that intent is a significant aspect to the enforcement of the Uniform Time Act of 1966. Indeed, if a community were to adopt legislation which was even infinitesimally contrary to the Uniform Time Act of 1966, we understand that the DoT would take steps to insure conformance to the Uniform Time Act. Since UTC has systematic and intended deviations from mean solar time, the Uniform Time Act of 1966 seems to be at some variance with the CCIR agreements and what is actually broadcast in the U.S.A. Further, the combination of the Uniform Time Act of 1966 (see Appendix I, ¶262) and Secnavinst 4120.15A, ¶ 4. a (see Appendix F) should require the USNO to distribute mean solar time (i. e., standard time) rather than UTC--this is contrary to fact (see Appendix G, Time Service Announcement, Series 14, No. 3, ¶2). Of course, the intent in these matters is not to avoid the Uniform Time Act but only to provide more generally useful frequency and time signals. Nonetheless, it is probably desirable to bring the U.S. laws into more formal agreement with the CCIR agreements.

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APPENDIX A

Definitions of the Second and IAT

Contents:

Definition of the Second;

Recommendations of the 5th Session of the  
Consultative Committee for the Definition of the Second;

Definition of IAT.

**RÉSOLUTIONS ADOPTÉES**  
**PAR LA 13<sup>e</sup> CONFÉRENCE GÉNÉRALE**

**Système International d'Unités (SI)**

Unité de temps (seconde)

**RÉSOLUTION**

*La Treizième Conférence Générale des Poids et Mesures,*

**CONSIDÉRANT**

*que la définition de la seconde décidée par le Comité International des Poids et Mesures à sa session de 1956 (Résolution 1) et ratifiée par la Résolution 9 de la Onzième Conférence Générale (1960), puis maintenue par la Résolution 5 de la Douzième Conférence Générale (1964) ne suffit pas aux besoins actuels de la métrologie,*

*qu'à sa session de 1964 le Comité International des Poids et Mesures, habilité par la Résolution 5 de la Douzième Conférence Générale (1964), a désigné pour répondre à ces besoins un étalon atomique de fréquence à césium à employer temporairement,*

*que cet étalon de fréquence est maintenant suffisamment éprouvé et suffisamment précis pour servir à une définition de la seconde répondant aux besoins actuels,*

*que le moment est venu de remplacer la définition actuellement en vigueur de l'unité de temps du Système International d'Unités par une définition atomique fondée sur cet étalon,*

**DÉCIDE**

*1<sup>o</sup> L'unité de temps du Système International d'Unités est la seconde définie dans les termes suivants :*

*« La seconde est la durée de 9 192 631 770 périodes de la radiation correspondant à la transition entre les deux niveaux hyperfins de l'état fondamental de l'atome de césium 133 ».*

*2<sup>o</sup> La Résolution 1 adoptée par le Comité International des Poids et Mesures à sa session de 1956 et la Résolution 9 de la Onzième Conférence Générale des Poids et Mesures sont abrogées.*

COMITE CONSULTATIF POUR LA DEFINITION DE LA SECONDE  
5<sup>e</sup> session (18-19 Juin 1970)

---

Recommandations  
du Comité Consultatif pour la Définition de la Seconde  
présentées  
au Comité International des Poids et Mesures

---

Proposition d'adoption d'une Echelle de Temps Atomique  
International

RECOMMANDATION S1 (1970)

Le Comité Consultatif pour la Définition de la Seconde,

CONSIDERANT

1° Le désir général de synchroniser ou de coordonner l'ensemble des émissions de signaux horaires diffusés dans le monde ;

2° le besoin d'une référence de temps uniforme pour l'étude de la dynamique des systèmes et, en particulier, pour l'étude des mouvements des corps célestes naturels et artificiels ;

3° l'utilité d'une échelle de temps aussi uniforme que possible pour servir de base à la comparaison des étalons de fréquence opérant en des lieux et à des instants différents ;

RECOMMANDE l'adoption d'une Echelle de Temps Atomique International.

Proposition de définition du Temps Atomique International

RECOMMANDATION S2 (1970)

Le Comité Consultatif pour la Définition de la Seconde propose de définir le Temps Atomique International (TAI) comme suit :

"Le Temps Atomique International est la coordonnée de repérage temporel établie par le Bureau International de l'Heure sur la base des indications d'horloges atomiques fonctionnant dans divers établissements conformément à la définition de la seconde, unité de temps du Système International d'Unités".



Poursuite des recherches sur les étalons atomiques de  
fréquence et sur les méthodes d'évaluation du Temps  
Atomique International

RECOMMANDATION S3 (1970)

Le Comité Consultatif pour la Définition de la Seconde,

CONSIDERANT que le nombre des étalons primaires de fréquence et leur exactitude sont à peine suffisants pour contrôler le maintien d'une durée constante de l'intervalle unitaire de l'Echelle de Temps Atomique International,

RECOMMANDE aux organismes compétents d'entreprendre ou de poursuivre activement les recherches en vue d'une réalisation plus exacte de la seconde du Système International d'Unités.

RECOMMANDATION S4 (1970)

Le Comité Consultatif pour la Définition de la Seconde,

CONSIDERANT que l'expérience acquise n'est pas suffisante pour que l'on puisse dès maintenant fixer les règles de pondération des indications des horloges atomiques contribuant à l'établissement de l'Echelle de Temps Atomique International,

RECOMMANDE que cette question soit étudiée activement.

## Mise en pratique du Temps Atomique International

Le Comité Consultatif pour la Définition de la Seconde propose les règles suivantes pour la mise en pratique de l'Echelle de Temps Atomique International pendant les quelques années à venir :

- 1° La durée de l'intervalle unitaire de l'Echelle de Temps Atomique International est déterminée par le Bureau International de l'Heure (B.I.H.) de façon qu'elle soit en accord étroit avec la durée de la seconde du Système International d'Unités rapportée à un point fixe de la Terre au niveau de la mer.
- 2° La durée de l'intervalle unitaire de l'Echelle de Temps Atomique International est maintenant aussi constante que possible. Elle est fréquemment comparée à la durée de la seconde du Système International d'Unités telle qu'elle est obtenue à l'aide des étalons primaires de fréquence de divers établissements. Les résultats de ces comparaisons sont portés à la connaissance du B.I.H.
- 3° La durée de l'intervalle unitaire de l'Echelle de Temps Atomique International n'est changée intentionnellement que si elle diffère d'une façon significative de la durée de la seconde spécifiée en 1°. Ces ajustements n'auront lieu qu'à des dates convenues à l'avance et annoncées par le B.I.H.
- 4° L'origine de l'Echelle de Temps Atomique International est définie conformément aux recommandations de l'Union Astronomique Internationale (XIII<sup>e</sup> Assemblée Générale, Prague, 1967), c'est-à-dire que cette échelle s'accorde approximativement avec le TU2 à 0 heure le 1<sup>er</sup> janvier 1958.
- 5° Le procédé par lequel le Temps Atomique International est actuellement porté à la connaissance des usagers, c'est-à-dire par la publication mensuelle des écarts des échelles locales, est considéré comme satisfaisant.

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Le Comité Consultatif pour la Définition de la Seconde note que ces recommandations et propositions vont dans le sens des demandes approuvées par le Comité Consultatif International des Radiocommunications (C.C.I.R.) à sa 12<sup>e</sup> Assemblée Plénière (New Delhi, 1970) et par l'Union Radioscientifique Internationale (U.R.S.I.) à sa 16<sup>e</sup> Assemblée Générale (Ottawa, 1969, Résolution 1.4).

RÉSOLUTIONS ADOPTÉES  
PAR LA 14<sup>e</sup> CONFÉRENCE GÉNÉRALE

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Temps Atomique International

**Rôle du Comité International des Poids et Mesures concernant le Temps Atomique International**

RÉSOLUTION 1

La Quatorzième Conférence Générale des Poids et Mesures,  
CONSIDÉRANT

que la seconde, unité de temps du Système International d'Unités, est définie depuis 1967 d'après une fréquence atomique naturelle, et non plus d'après des échelles de temps fournies par des mouvements astronomiques,

que le besoin d'une échelle de Temps Atomique International (TAI) est une conséquence de la définition atomique de la seconde,

que plusieurs organisations internationales ont assuré et assurent encore avec succès l'établissement des échelles de temps fondées sur des mouvements astronomiques, particulièrement grâce aux services permanents du Bureau International de l'Heure (B.I.H.),

que le Bureau International de l'Heure a commencé à établir une échelle de temps atomique dont les qualités sont reconnues et qui a prouvé son utilité,

que les étalons atomiques de fréquence servant à la réalisation de la seconde ont été considérés et doivent continuer de l'être par le Comité International des Poids et Mesures assisté d'un Comité Consultatif, et que l'intervalle unitaire de l'échelle de Temps Atomique International doit être la seconde réalisée conformément à sa définition Atomique,

que toutes les organisations scientifiques internationales compétentes et les laboratoires nationaux actifs dans ce domaine ont exprimé le désir que le Comité International et la Conférence Générale des Poids et Mesures donnent une définition du Temps Atomique International, et contribuent à l'établissement de l'échelle de Temps Atomique International,

que l'utilité du Temps Atomique International nécessite une coordination étroite avec les échelles de temps fondées sur des mouvements astronomiques,

## DEMANDE au Comité International des Poids et Mesures

1° de donner une définition du Temps Atomique International\* ;

2° de prendre les mesures nécessaires, en accord avec les organisations internationales intéressées, pour que les compétences scientifiques et les moyens d'action existants soient utilisés au mieux pour la réalisation de l'échelle de Temps Atomique International, et pour que soient satisfaits les besoins des utilisateurs du Temps Atomique International.

Arrangements avec le Bureau International de l'Heure concernant le Temps Atomique International

### RÉSOLUTION 2

La Quatorzième Conférence Générale des Poids et Mesures,  
CONSIDÉRANT

qu'une échelle de Temps Atomique International doit être mise à la disposition des utilisateurs,

que le Bureau International de l'Heure a prouvé qu'il est capable d'assurer ce service,

REND HOMMAGE au Bureau International de l'Heure pour l'oeuvre qu'il a déjà accomplie,

DEMANDE aux institutions nationales et internationales de bien vouloir continuer, et si possible augmenter, l'aide qu'elles donnent au Bureau International de l'Heure, pour le bien de la communauté scientifique et technique internationale,

AUTORISE le Comité International des Poids et Mesures à conclure avec le Bureau International de l'Heure les arrangements nécessaires pour la réalisation de l'échelle de Temps Atomique International à définir par le Comité International.

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\* En prévision de cette demande, le Comité International des Poids et Mesures avait chargé le Comité Consultatif pour la Définition de la Seconde de préparer une définition du Temps Atomique International. Cette définition, approuvée par le Comité International à sa 59<sup>e</sup> session (octobre 1970), est la suivante :

"Le Temps Atomique International est la coordonnée de repérage temporel établie par le Bureau International de l'Heure sur la base des indications d'horloges atomiques fonctionnant dans divers établissements conformément à la définition de la seconde, unité de temps du Système International d'Unités".

APPENDIX B  
Standard Frequency and Time Broadcast Agreements

Contents:  
CCIR Recommendation 460;  
CCIR Report 517.

## RECOMMENDATION 460

### STANDARD-FREQUENCY AND TIME-SIGNAL EMISSIONS

(Question 1/7)

The C.C.I.R.,

(1970)

#### CONSIDERING

- (a) the desirability of eliminating all offsets from nominal values in the carrier frequencies and in the time signals;
- (b) the desirability of disseminating on a world-wide basis precise time intervals in conformity with the definition of the second (SI), as adopted by the 13th General Conference of Weights and Measures (1967);
- (c) the continuing need of many users for Universal Time (UT);

#### UNANIMOUSLY RECOMMENDS

1. that, from a specified date, carrier frequencies and time intervals should be maintained constant and should correspond to the adopted definition of the second;
2. that the transmitted time scale should be adjusted when necessary in steps of exactly one second to maintain approximate agreement with Universal Time (UT);
3. that the standard-frequency and time-signal emissions should contain information on the difference between the time signals and Universal Time (UT);
4. that detailed instructions on the implementation of this Recommendation be adopted by Study Group 7 after consideration of the report of Interim Working Party 7/1;
5. that the standard-frequency and time-signal emissions should conform to §§ 1, 2, 3 and 4 above from 1 January 1972, 0000 h UT;
6. that this document be transmitted by the Director, C.C.I.R. to all Administrations Members of the I.T.U., to the Scientific Unions (I.A.U., I.U.G.G., U.R.S.I., I.U.P.A.P.), and other organizations such as B.I.H., C.I.P.M., I.C.A.O. and I.M.C.O.

STANDARD-FREQUENCY AND TIME-SIGNAL EMISSIONS

Detailed instructions by Study Group 7 for the implementation of Recommendation 460 concerning the improved Coordinated Universal Time (UTC) System, valid from 1 January 1972

(Question 1/7, Resolution 53)

(1971)

1. The XIIth Plenary Assembly of the C.C.I.R. adopted unanimously Recommendation 460. According to § 4 of this recommendation, Study Group 7 was entrusted with the task of formulating the detailed instructions for its implementation on 1 January 1972.

Study Group 7 met from 17 - 23 February 1971 and adopted the following text for this purpose :

2.

- 2.1 A special adjustment to the standard-frequency and time-signal emissions should be made at the end of 1971 so that the reading of the UTC scale will be 1 January 1972, 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup> at the instant when the reading of Atomic Time (AT) indicated by the Bureau International de l'Heure (B.I.H.) will be 1 January 1972, 0<sup>h</sup> 0<sup>m</sup> 10<sup>s</sup>. The necessary adjustments to emissions which are in accordance with Recommendation 374-2 will be specified and announced in advance by the B.I.H.

- 2.2 The departure of UTC from UT1 should not normally exceed 0.7s\*\*.

- 2.3 Inserted seconds should be called positive leap seconds and omitted seconds should be called negative leap seconds.

- 2.4 A positive or negative leap second, when required, should be the last second of a UTC month, preferably 31 December and/or 30 June. A positive leap second begins at 23<sup>h</sup> 59<sup>m</sup> 60<sup>s</sup> and ends at 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup> of the first day of the following month. In the case of a negative leap second, 23<sup>h</sup> 59<sup>m</sup> 58<sup>s</sup> will be followed one second later by 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup> of the first day of the following month. (See Annex I).

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\* This Report was adopted unanimously.

\*\* Universal Time

In applications in which errors of a few hundredths of a second cannot be tolerated, it is necessary to specify the form of Universal Time (UT), referred to in Recommendation 460, which should be used.

UT1 is a form of UT in which corrections have been applied for the effects of small movements of the Earth relative to the axis of rotation.

UT2 is UT1 corrected for the effects of a small seasonal change in the rate of rotation of the Earth.

UT1 corresponds directly with the angular position of the Earth around its axis of rotation, and is used in this document. GMT may be regarded as the general equivalent of UT1.

- 2.5 The B.I.H. should decide upon and announce the occurrence of a leap second; such an announcement is to be made at least eight weeks in advance.
- 2.6 The time signals of standard-frequency and time-signal emissions should be kept as close to UTC as possible, with a maximum deviation of one millisecond.
- 3.
- 3.1 The approximate value of the difference UT1 minus UTC, as disseminated with the time signals should be denoted DUT1,  
where  $DUT1 \approx UT1 - UTC$ .
- DUT1 may be regarded as a correction to be added to UTC to obtain an approximation of UT1.
- 3.2 The values of DUT1 should be given in integral multiples of 0.1 s. The BIH is requested to determine and to circulate one month in advance the value of DUT1. Administrations and organizations should use the B.I.H. value of DUT1 for standard-frequency and time-signal emissions whenever possible, and are requested to circulate the information as widely as possible in periodicals, bulletins, etc.
- 3.3 Where DUT1 is disseminated by code, the code should be in accordance with the following principles :
- the magnitude of DUT1 is specified by the number of emphasized seconds markers and the sign of DUT1 is specified by the position of the emphasized seconds markers with respect to the minute marker. The absence of emphasized markers indicates  $DUT1 = 0$ ;
  - the coded information should be emitted after each identified minute.
- Full details of the code are given in Annex II.
- 3.4 Alternatively DUT1 may be given by voice announcement or in morse code.
- 3.5 In addition, UT1-UTC may be given to the same or higher precision by other means, for example, in morse or voice announcements, by messages associated with maritime bulletins, weather forecasts, etc.; announcements of forthcoming leap seconds may also be made by these methods.
- 3.6 The B.I.H. is requested to continue to publish in arrears definitive values of the differences UT1-UTC, UT2-UTC and AT(B.I.H.)-UTC.



ANNEX I

(to Report 517)

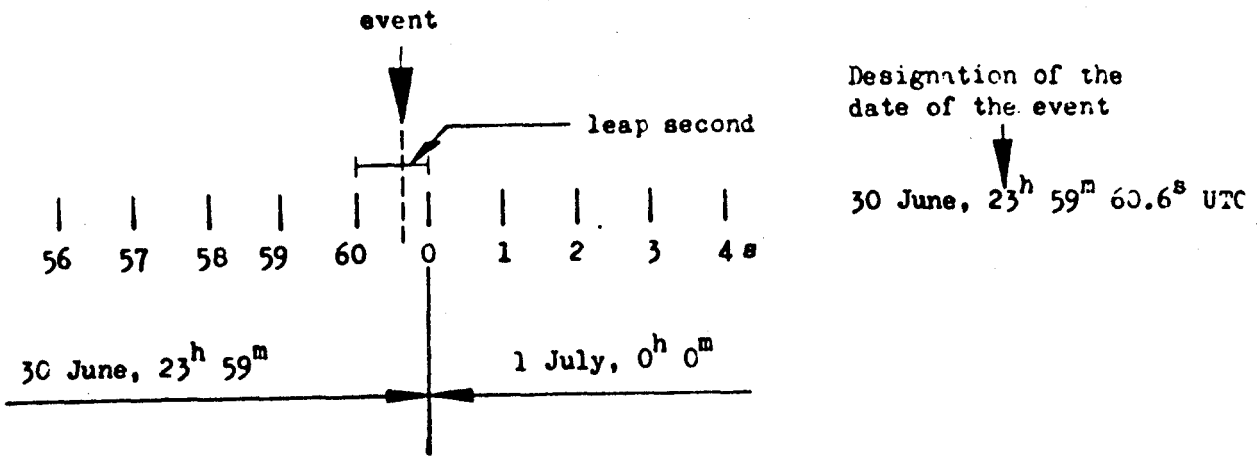
DATING OF EVENTS IN THE VICINITY OF A LEAP SECOND

(Taken from § 2.4 of the Report)

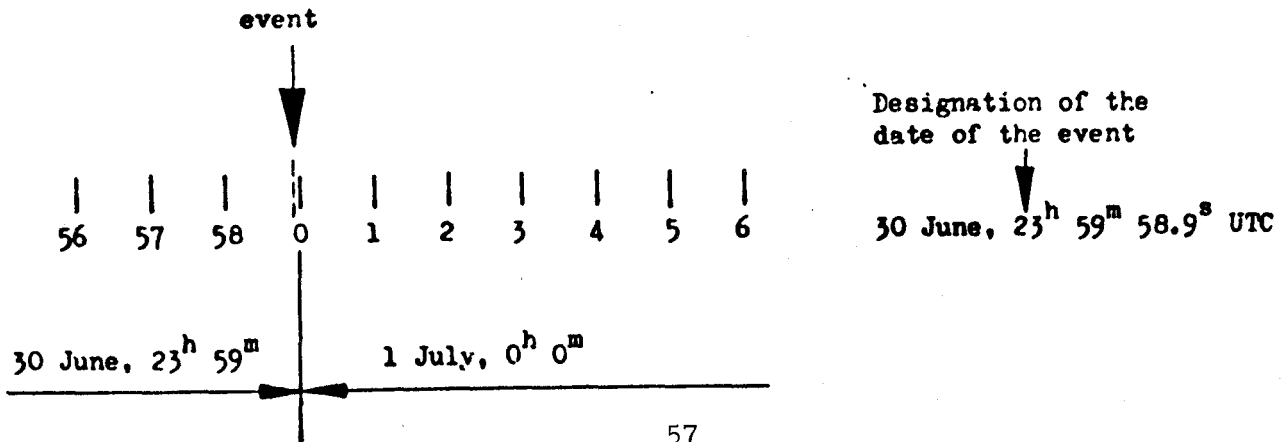
A positive or negative leap second, when required, should be the last second of a UTC month, preferably 31 December and/or 30 June. A positive leap second begins at 23<sup>h</sup> 59<sup>m</sup> 60<sup>s</sup> and ends at 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup> of the first day of the following month. In the case of a negative leap second, 23<sup>h</sup> 59<sup>m</sup> 58<sup>s</sup> will be followed one second later by 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup> of the first day of the following month.

Taking account of what has been said in the preceding paragraph, the dating of events in the vicinity of a leap second shall be effected in the manner indicated in the following figures :

Positive leap second



Negative leap second



ANNEX II

(to Report 517)

CODE FOR THE TRANSMISSION OF DUTI

A positive value of DUTI will be indicated by emphasizing a number (n) of consecutive seconds markers following the minute marker from seconds markers one to seconds marker (n) inclusive; (n) being an integer from 1 to 7 inclusive.

$$DUTI = (n \times 0.1)s$$

A negative value of DUTI will be indicated by emphasizing a number (m) of consecutive seconds markers following the minute marker from seconds marker nine to seconds marker (8 + m) inclusive; (m) being an integer from 1 to 7 inclusive.

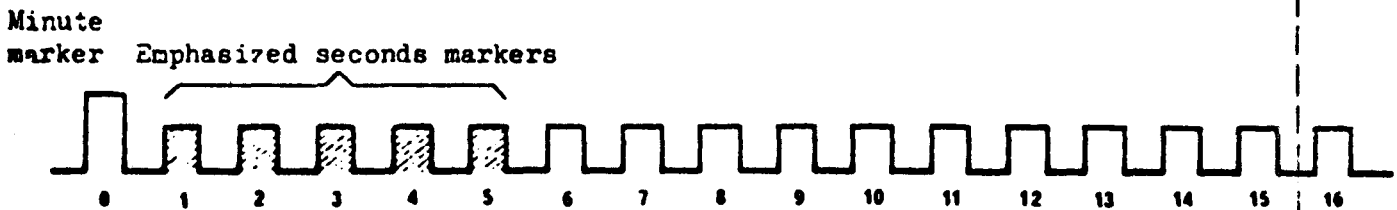
$$DUTI = -(m \times 0.1)s$$

A zero value of DUTI will be indicated by the absence of emphasized seconds markers.

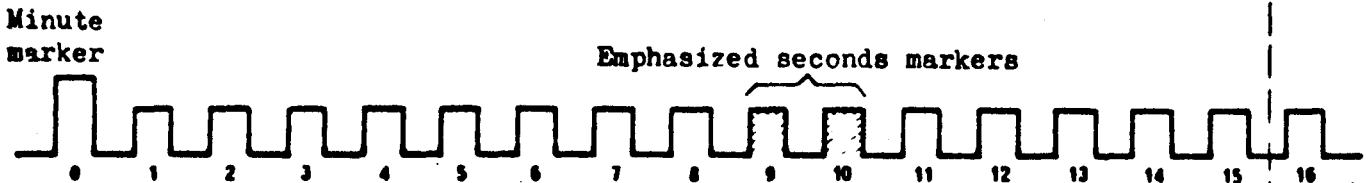
The appropriate seconds markers may be emphasized, for example, by lengthening, doubling, splitting, or tone modulation of the normal seconds markers.

EXAMPLES

$$DUTI = + 0.5s$$



$$DUTI = - 0.2s$$



limit of coded sequence →

APPENDIX C  
NBS Enabling Legislation

Contents:

NBS Legislative Authority (15 U.S.C. 272);  
Departmental Organizational Order 30-2A;  
Departmental Organizational Order 30-2B.

<b>U. S. DEPARTMENT OF COMMERCE</b> <b>NATIONAL BUREAU OF STANDARDS</b>  <b>ADMINISTRATIVE</b> <b>MANUAL</b>	Chapter 1	Authority
	Subchapter 1	Legislative Authority

LEGISLATIVE AUTHORITY

Sections

- 1.01.01 Basic Legislation
- 1.01.02 Bureau Established
- 1.01.03 Functions of Secretary
- 1.01.04 Functions: For Whom Exercised
- 1.01.05 Director: Powers and Duties
- 1.01.06 Appointment of Officers and Employees
- 1.01.07 Service Charges
- 1.01.08 Ownership of Facilities
- 1.01.09 Regulations
- 1.01.10 Visiting Committee
- 1.01.11 Gifts and Bequests
- 1.01.12 Working Capital Fund
- 1.01.13 Acquisition of Land for Field Sites
- 1.01.14 Construction and Improvement of Buildings and Facilities
- 1.01.15 Functions and Activities
- 1.01.16 Fire Research and Safety
- 1.01.17 Testing Materials for District of Columbia
- 1.01.18 National Hydraulic Laboratory
- 1.01.19 Other Legislation
  - a. Standards of Electrical and Photometric Measurement
  - b. Research Associates
- 1.01.20 Authority for Certain Expenditures

1.01.01

**BASIC LEGISLATION**

The National Bureau of Standards was established on March 3, 1901, by "An Act to Establish the National Bureau of Standards" (31 Stat. 1449). Extensive amendments were made in 1950 by passage of Public Law 81-619 (64 Stat. 371); in 1956 by Public Law 84-940, (70 Stat. 959); and in 1958 by Public Law 85-890 (72 Stat. 1711). The provisions of the organic act and amendments are merged in the following statement of basic legislation quoted from Title 15 of the United States Code.

1.01.02

**BUREAU ESTABLISHED**

(15 U.S.C. 271)  
 "The Office of Standard Weights and Measures shall be known as the National Bureau of Standards."

1.01.03

**FUNCTIONS OF SECRETARY**

(15 U.S.C. 272)  
 "The Secretary of Commerce (hereinafter referred to as the "Secretary") is authorized to undertake the following functions:

"(a) The custody, maintenance, and development of the national standards of measurement, and the provision of means and methods for making measurements consistent with those standards, including the comparison of standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government.

"(b) The determination of physical constants and properties of materials when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere.

"(c) The development of methods for testing materials, mechanisms, and structures, and the testing of materials, supplies, and equipment, including items purchased for use of Government departments and independent establishments.

"(d) Cooperation with other governmental agencies and with private organizations in the establishment of standard practices, incorporated in codes and specifications.

"(e) Advisory service to Government agencies on scientific and technical problems.

"(f) Invention and development of devices to serve special needs of the Government.

"In carrying out the functions enumerated in this section, the Secretary is authorized to undertake the following activities and similar ones for which need may arise in the operations of Government agencies, scientific institutions, and industrial enterprises:

"(1) the construction of physical standards;

"(2) the testing, calibration, and certification of standards and standard measuring apparatus;

"(3) the study and improvement of instruments and methods of measurements;

"(4) the investigation and testing of railroad track scales, elevator scales, and other scales used in weighing commodities for interstate shipment;

"(5) cooperation with the States in securing uniformity in weights and measures laws and methods of inspection;

"(6) the preparation and distribution of standard samples such as those used in checking chemical analyses, temperature, color, viscosity, heat of combustion, and other basic properties of materials; also the preparation and sale or other distribution of standard instruments, apparatus and materials for calibration of measuring equipment;

"(7) the development of methods of chemical analysis and synthesis of materials, and the investigation of the properties of rare substances;

"(8) the study of methods of producing and of measuring high and low temperatures; and the behavior of materials at high and at low temperatures;

"(9) the investigation of radiation, radioactive substances, and X-rays, their uses, and means of protection of persons from their harmful effects;

"(10) the study of the atomic and molecular structure of the chemical elements, with particular reference to the characteristics of the spectra emitted, the use of spectral observations in determining chemical composition of materials, and the relation of molecular structure to the practical usefulness of materials;

"(11) the broadcasting of radio signals of standard frequency;

"(12) the investigation of the conditions which affect the transmission of radio waves from their source to a receiver;

"(13) the compilation and distribution of information on such transmission of radio waves as a basis for choice of frequencies to be used in radio operations;

"(14) the study of new technical processes and methods of fabrication of materials in which the Government has a special interest; also the study of methods of measurement and technical processes used in the manufacture of optical glass and pottery, brick, tile, terra cotta, and other clay products;

"(15) the determination of properties of building materials and structural elements, and encouragement of their standardization and most effective use, including investigation of fire-resisting properties of building materials and conditions under which they may be most efficiently used, and the standardization of types of appliances for fire prevention;

"(16) metallurgical research, including study of alloy steels and light metal alloys; investigation of foundry practice, casting, rolling, and forging; prevention of corrosion of metals and alloys; behavior of bearing metals; and development of standards for metals and sands;

"(17) the operation of a laboratory of applied mathematics;

"(18) the prosecution of such research in engineering, mathematics, and the physical sciences as may be necessary to obtain basic data pertinent to the functions specified herein; and

"(19) the compilation and publication of general scientific and technical data resulting from the performance of the

functions specified herein or from other sources when such data are of importance to scientific or manufacturing interests or to the general public, and are not available elsewhere, including demonstration of the results of the Bureau's work by exhibits or otherwise as may be deemed most effective."

#### 1.01.04

FUNCTIONS: FOR WHOM EXERCISED  
(15 U.S.C. 273)

"The bureau shall exercise its functions for the Government of the United States; for any State or municipal government within the United States; or for any scientific society, educational institution, firm, corporation, or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring instruments. All requests for the services of the bureau shall be made in accordance with the rules and regulations established in sections 276 and 277 of this title [15 U.S.C.]."

#### 1.01.05

DIRECTOR: POWERS AND DUTIES  
(15 U.S.C. 274)

"The director shall be appointed by the President, by and with the advice and consent of the Senate. He shall have the general supervision of the bureau, its equipment, and the exercise of its functions. He shall make an annual report to the Secretary of Commerce, including an abstract of the work done during the year and a financial statement. He may issue, when necessary, bulletins for public distribution, containing such information as may be of value to the public or facilitate the bureau in the exercise of its functions."

## 1.01.06

APPOINTMENT OF OFFICERS AND EMPLOYEES  
(15 U.S.C. 275)

"The officers and employees of the bureau, except the director, shall be appointed by the Secretary of Commerce at such time as their respective services may become necessary."

to be attained in standards submitted for verification, the sealing of standards, the disbursement and receipt of moneys, and such other matters as he may deem necessary for carrying into effect sections 271-278b of this title [15 U.S.C.]."

## 1.01.07

SERVICE CHARGES  
(15 U.S.C. 275a)

"The Secretary shall charge for services performed under the authority of section 273 of this title, [15 U.S.C.] except in cases where he determines that the interest of the Government would be best served by waiving the charge. Such charges may be based upon fixed prices or costs. The appropriation or fund bearing the cost of the services may be reimbursed, or the Secretary may require advance payment subject to such adjustment on completion of the work as may be agreed upon."

## 1.01.10

VISITING COMMITTEE  
(15 U.S.C. 278)

"There shall be a visiting committee of five members to be appointed by the Secretary of Commerce, to consist of men prominent in the various interests involved, and not in the employ of the Government. This committee shall visit the bureau at least once a year, and report to the Secretary of Commerce upon the efficiency of its scientific work and the condition of its equipment. The members of this committee shall serve without compensation, but shall be paid the actual expenses incurred in attending its meetings. The period of service of the members of the committee shall be so arranged that one member shall retire each year, and the appointments to be for a period of five years. Appointments made to fill vacancies occurring other than in the regular manner are to be made of the remainder of the period in which the vacancy exists."

## 1.01.08

OWNERSHIP OF FACILITIES  
(15 U.S.C. 276)

"In the absence of specific agreement to the contrary, additional facilities, including equipment, purchased pursuant to the performance of services authorized by section 273 of this title [15 U.S.C.] shall be come the property of the Department of Commerce."

## 1.01.11

## GIFTS AND BEQUESTS

(15 U.S.C. 278a Repealed)

Section 4(a)(1) of Public Law 88-611, dated October 2, 1964 [78 Stat. 991, 5 U.S.C. 608a, 608b] repealed special statutory authority previously existing at NBS with respect to the acceptance of gifts and bequests. Gifts and bequests received are

## 1.01.09

REGULATIONS  
(15 U.S.C. 277)

"The Secretary of Commerce shall, from time to time, make regulations regarding the payment of fees, the limits of tolerance

United States of America  
DEPARTMENT OF COMMERCE

*Reorganization* 30-2A  
DEPARTMENT ORDER ~~90-A~~  
*See Am 1*

**DEPARTMENT  
ORDER SERIES**

DATE OF ISSUANCE

October 1, 1968

EFFECTIVE DATE

October 1, 1968

SUBJECT

NATIONAL BUREAU OF STANDARDS

SECTION 1. PURPOSE.

The purpose of this order is to delegate authority to the Director of the National Bureau of Standards, hereinafter referred to as the Director, and to prescribe the functions of the National Bureau of Standards, hereinafter referred to as the Bureau.

SECTION 2. GENERAL.

.01 The National Bureau of Standards, established by Act of March 3, 1901, (31 Stat. 1449; 15 U.S.C. 271) is hereby continued as a primary operating unit of the Department of Commerce.

.02 The Director, who is appointed by the President by and with the advice and consent of the Senate, is the head of the Bureau. The Director shall report and be responsible to the Assistant Secretary for Science and Technology.

.03 The Director shall be assisted by a Deputy Director, who shall be the principal assistant to the Director and shall perform the functions of the Director during the latter's absence or disability. He shall also serve as Acting Director whenever the position of Director is vacant, unless and until the Secretary shall make a further designation. In the absence of both the Director and Deputy Director, an employee of the Bureau designated in writing by the Director shall act as Director.

SECTION 3. DELEGATION OF AUTHORITY.

.01 Pursuant to authority vested in the Secretary of Commerce by law (including Reorganization Plans No. 3 of 1946, No. 5 of 1950, and No. 2 of 1965), and subject to such policies and directives as the Secretary of Commerce or the Assistant Secretary for Science and Technology may prescribe, and with the exceptions set forth in paragraph .02 of this section, the Director is hereby delegated the authority to perform the functions vested in the Secretary of Commerce by the following Chapters of Title 15, United States Code:

- a. Chapter 6 (Weights and Measures);
- b. Chapter 7 (The Bureau of Standards, except for those activities pertaining to electromagnetic and sound wave propagation phenomena and geacoustics which have been assigned to the Environmental Science Services Administration);
- c. Chapter 23 (Dissemination of Technical, Scientific, and Engineering Information);
- d. Chapter 25 (Flammable Fabrics);
- e. Chapter 26 (Household Refrigerators); and
- f. Chapter 39 (Fair Packaging and Labeling).

.02 The above delegations of authority are subject to the following limitations:

- a. The Director may issue such regulations as he considers necessary to carry out his responsibilities, except that procedural regulations pertaining to the formulation, adoption, or publication of voluntary or mandatory product standards, as provided for or authorized by Chapters 7, 25, 26, and 39 of Title 15, U.S. Code, are to be issued by the Assistant Secretary for Science and Technology.



b. With respect to Chapter 25 of Title 15, U.S. Code, the authorities to adopt final flammability standards, to appoint members of, and deal with, the National Advisory Committee for the Flammable Fabrics Act, and to transmit an annual report of the results of the Department's activities in carrying out the Flammable Fabrics Act, as amended, are reserved to the Secretary. The authority to make determinations of possible need for, and to institute proceedings for the determination of, a flammability standard or other regulation is delegated to the Assistant Secretary for Science and Technology by Department Order 177.

c. The authority to prescribe and publish commercial standards, pursuant to Section 1213, Chapter 26, Title 15, U.S. Code, is reserved to the Secretary.

d. With respect to Chapter 39 of Title 15, U.S. Code, the authority delegated in this order excludes the authority to make determinations of (1) an undue proliferation of weights, measures, or quantities, pursuant to 15 U.S.C. 1454 (d), and (2) the non-adoption of standards or the non-observance of adopted standards, pursuant to 15 U.S.C. 1454 (e), which authorities have been delegated to the Assistant Secretary for Science and Technology. The authorities to submit reports to the Congress concerning non-adoption or failure to observe voluntary product standards, pursuant to 15 U.S.C. 1454 (e), and to transmit an annual report to the Congress, as required by 15 U.S.C. 1457, are reserved to the Secretary.

.03 The Director is further delegated the authority to perform the functions assigned to the Secretary by Section 759(f), Chapter 16, Title 40, United States Code, pertaining to the conduct of research and the provision of scientific and technological advisory services relating to automatic data processing (ADP) and related systems, except that recommendations to the President concerning the establishment of uniform Federal ADP standards will be submitted by the Secretary.

.04 The Director is further delegated the authority to perform the functions vested in the Secretary by:

a. Public Law 90-396 (82 Stat. 339), called the Standard Reference Data Act; and

b. Public Law 90-472 (82 Stat. 693) authorizing a metric system study to be made, except that submission of reports and recommendations thereon to the Congress shall be reserved to the Secretary.

*See Am 1 (12/26/68)*

.05 Pursuant to the authority delegated to the Secretary by the Administrator of the General Services Administration (Temporary Regulation E-10, July 11, 1967, Federal Property Management Regulations), and subject to such policies and directives as the Secretary or the Assistant Secretary for Science and Technology may prescribe, the Director is hereby delegated authority to operate an automatic data processing service center.

.06 The authority delegated to the Secretary by the Administrator of the General Services Administration, dated August 15, 1967, (32 F.R. 11969), to appoint uniformed guards as special policemen and to make all needful rules and regulations for the protection of those parcels of property at National Bureau of Standards installations which are not protected by GSA guards, and over which the Federal Government has exclusive or concurrent jurisdiction, is hereby redelegated to the Director. This authority shall be exercised in accordance with the requirements of the Federal Property and Administrative Services Act of 1949 (63 Stat. 377), as amended, and the Act of June 1, 1948 (62 Stat. 281), as amended, and policies, procedures, and controls of the General Services Administration.

.07 The Director of the National Bureau of Standards may redelegate his authority to appropriate officials of the National Bureau of Standards, subject to such conditions in the exercise of such authority as he may prescribe.

#### SECTION 4. FUNCTIONS.

.01 The National Bureau of Standards shall perform the following functions:

a. Develop and maintain the national standards of measurement, and provide means for making measurements consistent with those standards;

- b. Determine the physical constants and properties of materials;
- c. Develop methods for testing materials, mechanisms, and structures, and conduct such tests thereof as may be necessary, with particular reference to the needs of Government agencies;
- d. Cooperate with and assist industry, business, consumers, and governmental organizations in the establishment, technical review, determination of acceptability, and publication of voluntary standards, recommended specifications, standard practices, and model codes and ordinances;
- e. Provide advisory service to Government agencies on scientific and technical problems;
- f. Conduct a program for the collection, compilation, critical evaluation, publication, and dissemination of standard reference data;
- g. Invent and develop devices to serve special scientific and technological needs of the Government;
- h. Conduct programs, in cooperation with United States business groups and standards organizations, for the development of international standards of practice;
- i. Conduct a program of research, investigation, and training with respect to the flammability characteristics of textiles and fabrics;
- j. Maintain a clearinghouse for the collection and dissemination of scientific, technical, and engineering information;
- k. Conduct research and provide technical services designed to improve the effectiveness of use by the Federal Government of computers and related techniques; and
- l. Conduct a national fire research and safety program, (as provided for by Public Law 90-259 (82 Stat. 34-39) amending Chapter 7 of Title 15, United States Code).

.02 The Bureau shall perform the following functions, pursuant to the Fair Packaging and Labeling Act (Chapter 39, Title 15, United States Code):

- a. Ascertain the number and other characteristics of the weights, measures, and quantities in which commodities are packaged for retail sale;
- b. Conduct studies of the relationship between the weights, measures, and quantities in which commodities are packaged and the ability of consumers to make value comparisons;
- c. Conduct studies concerning the extent to which voluntary product standards adopted pursuant to 15 U.S.C. 1454 are being followed by industry;
- d. Distribute copies of regulations and standards promulgated under this chapter, and provide information and assistance to appropriate State officials, to promote uniformity in State and Federal regulation of the labeling of consumer commodities;
- e. Provide reports and recommendations to the Assistant Secretary for Science and Technology, and perform such other activities as he may request to facilitate discharge of his responsibilities under the Act; and
- f. Conduct such other studies, investigations, and standards development activities as are necessary to achieve the objectives of the Act.

.03 The Bureau, as appropriate, will request the views of, and provide an opportunity for participation by, the Business and Defense Services Administration in the development and execution of its responsibilities for conducting investigations and analyses, and for developing or appraising product standards, under the Flammable Fabrics Act, the Fair Packaging and Labeling Act, or other Bureau authorities.

SECTION 5. EFFECT ON OTHER ORDERS.

This order supersedes Department Order 90-A of May 12, 1966, as well as those provisions relating to the National Bureau of Standards contained in the Directive of the Assistant Secretary for Science and Technology, dated May 24, 1967 (32 F.R. 7876).



Acting Secretary of Commerce

United States of America  
DEPARTMENT OF COMMERCE

*Organization*  
DEPARTMENT ORDER ~~90-A~~ 30-2A  
Amendment 1

**DEPARTMENT  
ORDER SERIES**

DATE OF ISSUANCE  
December 26, 1968

EFFECTIVE DATE  
December 26, 1968

SUBJECT

NATIONAL BUREAU OF STANDARDS

Department Order 90-A of October 1, 1968, is hereby amended as follows:

SECTION 3. DELEGATION OF AUTHORITY. A new subparagraph .04c. is added to read:

"c. Public Law 85-934 (72 Stat 1793; 42 U.S.C. 1891-3) to make grants for the support of basic scientific research to nonprofit institutions of higher education and to nonprofit organizations whose primary purpose is the conduct of scientific research."

  
Secretary of Commerce

<p align="center"><b>United States of America DEPARTMENT OF COMMERCE</b></p>	<p align="center">DEPARTMENT ORGANIZATION ORDER <u>30-2B</u></p>	
<p align="center"><b>DEPARTMENT ORGANIZATION ORDER SERIES</b></p>	<p align="center">DATE OF ISSUANCE  November 16, 1970</p>	<p align="center">EFFECTIVE DATE  November 16, 1970</p>
<p><b>SUBJECT</b></p> <p align="center">NATIONAL BUREAU OF STANDARDS</p>		
<p><u>SECTION 1. PURPOSE.</u></p> <p>This order prescribes the organization and assignment of functions within the National Bureau of Standards (NBS).</p> <p><u>SECTION 2. ORGANIZATION.</u></p> <p>The organization structure and line of authority of the National Bureau of Standards shall be as depicted in the attached organization chart.</p> <p><u>SECTION 3. OFFICE OF THE DIRECTOR.</u></p> <p>.01 The <u>Director</u> determines the policies of the Bureau and directs the development and execution of its programs.</p> <p>.02 The <u>Deputy Director</u> assists the Director in the direction of the Bureau and performs the functions of the Director in the latter's absence.</p> <p><u>SECTION 4. STAFF UNITS REPORTING TO THE DIRECTOR.</u></p> <p>.01 The <u>Office of Academic Liaison</u> shall serve as the focal point for the Bureau's cooperation with the academic institutions, and serve as liaison office for cooperative research activities between the Bureau and other Government agencies.</p> <p>.02 The <u>Office of Legal Adviser</u> shall, under the professional supervision of the Department's General Counsel and as provided in Department Organization Order 10-6, serve as the law office of and have responsibility for all legal services at the National Bureau of Standards.</p> <p><u>SECTION 5. OFFICE OF THE ASSOCIATE DIRECTOR FOR PROGRAMS.</u></p> <p>The <u>Office of the Associate Director for Programs</u> shall perform the functions of policy development, program analysis, and program promotion; sponsor and coordinate the performance of issue and impact studies; relate Bureau programs to national needs; generate planning formats and develop information on NBS program plans and status for internal and external audiences; administer evaluation panels; and define alternatives for the allocation of resources and advise Bureau management on their implications.</p> <p><u>SECTION 6. OFFICE OF THE ASSOCIATE DIRECTOR FOR ADMINISTRATION.</u></p> <p>.01 The <u>Associate Director for Administration</u> shall be the principal assistant and adviser to the Director on management matters and is responsible for the conduct of administrative management functions, including the management of NBS buildings, plants, and non-scientific facilities. He shall carry out these responsibilities primarily through the organization units specified below, which are under his direction.</p> <p>.02 The <u>Accounting Division</u> shall administer the official system of central fiscal records, payments and reports, and provide staff assistance on accounting and related matters.</p> <p>.03 The <u>Administrative Services Division</u> shall be responsible for security, safety, emergency planning, and civil defense activities; provide mail, messenger, communications, duplicating, and related office services; manage use of auditorium and conference rooms; conduct records and forms management programs; operate an NBS records holding area; manage the NBS motor vehicle fleet; and provide janitorial service.</p>		

.04 The Budget Division shall provide advice and assistance to line management in the preparation, review, presentation, and management of the Bureau's budget encompassing its total financial resources.

.05 The Management and Organization Division shall provide consultative services to line management in organization, procedures, and management practices; develop administrative information systems; maintain the directives system; and perform reports management functions.

.06 The Personnel Division shall advise on personnel policy and utilization; administer recruitment, placement, classification, employee development and employee relations activities; and assist operating officials on these and other aspects of personnel management.

.07 The Plant Division shall maintain the physical plant at Gaithersburg, Maryland, and perform staff work in planning and providing grounds, buildings, and improvements at other Bureau locations.

.08 The Supply Division shall procure and distribute material, equipment, and supplies purchased by the Bureau, keep records and promote effective utilization of property, act as the Bureau coordinating office for research, construction, supply and lease contracts of the Bureau, and administer telephone communications services and travel services.

.09 The Instrument Shops Division shall design, construct, and repair precision scientific instruments and auxiliary equipment.

#### SECTION 7. OFFICE OF THE ASSOCIATE DIRECTOR FOR INFORMATION PROGRAMS.

.01 The Associate Director for Information Programs shall promote optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promote 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; provide appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world; and direct public information activities of the Bureau.

.02 The Office of Standard Reference Data shall administer the National Standard Reference Data System which provides critically evaluated data in the physical sciences on a national basis. This requires arrangement for the continuing systematic review of the national and international scientific literature in the physical sciences, the evaluation of the data it contains, the stimulation of research needed to fill important gaps in the data, and the compilation and dissemination of evaluated data through a variety of publication and reference services tailored to user needs in science and industry.

.03 The Office of Technical Information and Publications shall foster the outward communication of the Bureau's scientific findings and related technical data to science and industry through reports, articles, conferences and meetings, films, correspondence and other appropriate mechanisms; and assist in the preparation, scheduling, printing and distribution of Bureau publications.

.04 The Library Division shall furnish diversified information services to the staff of the Bureau, including conventional library services, bibliographic, reference, and translation services; and serve as a reference and distribution center for Congressional legislative materials and issuances of other agencies.

.05 The Office of Public Information shall conduct the public information activities of the Bureau, including coordination of relations with the general press, and policy guidance for inquiry service for the general public.

.06 The Office of International Relations shall serve as the focal point for Bureau activities in the area of international scientific exchanges.

SECTION 8. CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY.

.01 The Center for Computer Sciences and Technology shall conduct research and provide 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 (Public Law 89-306); and serve as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages.

.02 The Director shall direct the development, execution, and evaluation of the programs of the Center.

.03 The functions of the organizational units of the Center are as follows:

a. The Office of Information Processing Standards shall provide leadership and coordination for Government efforts in the development of information processing standards at the Federal, national, and international levels.

b. The Office of Computer Information shall function as a specialized information center for computer sciences and technology.

c. The Computer Services Division shall provide computing and data conversion services to NBS and other agencies on a reimbursable basis; and provide supporting problem analysis and computer programming as required.

d. The Systems Development Division shall conduct research in information sciences and computer programming; develop advanced concepts for the design and implementation of data processing systems; and provide consultative services to other agencies in software aspects of the design and implementation of data processing systems.

e. The Information Processing Technology Division shall conduct research and development in selected areas of information processing technology and related disciplines to improve methodologies and to match developing needs with new or improved techniques and tools.

SECTION 9. INSTITUTE FOR BASIC STANDARDS.

.01 The Institute for Basic Standards shall provide the central basis within the United States of a complete and consistent system of physical measurement; coordinate that system with measurement systems of other nations; and furnish essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce.

.02 The Office of the Director.

a. The Director shall direct the development, execution, and evaluation of the programs of the Institute.

b. The Deputy Director shall assist in the direction of the institute and perform the functions of the Director in the latter's absence.

c. The Deputy Director, Institute for Basic Standards/Boulder shall assist in the direction of the Institute's programs at Boulder and report to the Associate Director for Administration through the Director, IBS, in supervising the administrative divisions at Boulder.

d. The administrative divisions reporting to the Deputy Director, Institute for Basic Standards/Boulder, include:

Administrative Services Division  
Plant Division  
Instrument Shops Division

These divisions and units within his office shall provide staff support for the technical program and administrative services for the NBS organization at Boulder, Colorado. The administrative units and divisions shall also service, as needed, National Oceanic and Atmospheric Administration and Office of Telecommunications units at Boulder, Colorado, and associated field stations.

.03 The Office of Measurement Services shall coordinate the Bureau's measurement services program, including development and dissemination of uniform policies on Bureau calibration practices.

.04 The Center for Radiation Research shall constitute a prime resource within the Bureau for the application of radiation, not only to Bureau mission problems, but also to those of other agencies and other institutions. The resulting multipurpose and collaborative functions reinforce the capability of the Center for response to Bureau mission problems.

a. The Director shall report to the Director, Institute for Basic Standards, and shall direct the development, execution, and evaluation of the programs of the Center. The Deputy Director shall assist in the direction of the Center and perform the functions of the Director in the absence of the latter.

b. The organizational units of the Center for Radiation Research are as follows:

Linac Radiation Division  
Nuclear Radiation Division  
Applied Radiation Division

Each of these Divisions shall engage in research, measurement, and application of radiation to the solution of Bureau and other institutional problems, primarily through collaboration.

.05 The other organization units of the Institute for Basic Standards are as follows:

Located at Bureau Hdqrs.

Applied Mathematics Division  
Electricity Division  
Heat Division  
Mechanics Division  
Optical Physics Division

Located at Boulder, Colorado

Cryogenics Division  
Electromagnetics Division  
Laboratory Astrophysics Division  
Quantum Electronics Division  
Time and Frequency Division

a. Each Division except the Applied Mathematics Division shall engage in such of the following functions as are appropriate to the subject matter field of the Division:

1. Develop and maintain the national standards for physical measurement, develop appropriate multiples and sub-multiples of prototype standards, and develop transfer standards and standard instruments;
2. Determine important fundamental physical constants which may serve as reference standards, and analyze the self-consistencies of their measured values;
3. Conduct experimental and theoretical studies of fundamental physical phenomena of interest to scientists and engineers with the general objective of improving or creating new measurement methods and standards to meet existing or anticipated needs;
4. Conduct general research and development on basic measurement techniques and instrumentation, including research on the interaction of basic measuring processes on the properties of matter and physical and chemical processes;
5. Calibrate instruments in terms of the national standards, and provide other measurement services to promote accuracy and uniformity of physical measurements;



6. Correlate with other nations the national standards and definitions of the units of measurement; and
7. Provide advisory services to Government, science, and industry on basic measurement problems.
- b. The Applied Mathematics Division shall conduct research in various fields of mathematics important to physical and engineering sciences, automatic data processing, and operations research, with emphasis on statistical, numerical and combinatorial analysis and systems dynamics; provide consultative services to the Bureau and other Federal agencies; and develop and advise on the use of mathematical tools, in checking mathematical tables, handbooks, manuals, mathematical models, and computational methods.

SECTION 10. INSTITUTE FOR MATERIALS RESEARCH.

.01 The Institute for Materials Research shall conduct materials research leading to improved methods of measurement, standards, and data on the properties of materials needed by industry, commerce, educational institutions, and Government; provide advisory and research services to other Government agencies; and develop, produce, and distribute standard reference materials.

.02 The Director shall direct the development, execution and evaluation of the programs of the Institute. The Deputy Director shall assist in the direction of the Institute and perform the functions of the Director in the latter's absence.

.03 The Office of Standard Reference Materials shall evaluate the requirements of science and industry for carefully characterized reference materials which provide a basis for calibration of instruments and equipment, comparison of measurements and materials, and aid in the control of production processes in industry; and stimulate the Bureau's efforts to develop methods for production of needed reference materials and direct their production and distribution.

.04 The other organization units of the Institute for Materials Research are as follows:

- Analytical Chemistry Division
- Polymers Division
- Metallurgy Division
- Inorganic Materials Division
- Physical Chemistry Division
- Reactor Radiation Division

Each Division shall engage in such of the following functions as are appropriate to the subject matter field of the Division:

- a. Conduct research on the chemical and physical constants, constitution, structure, and properties of matter and materials;
- b. Devise and improve methods for the preparation, purification, analysis, and characterization of materials;
- c. Investigate fundamental chemical and physical phenomena related to materials of importance to science and industry, such as fatigue and fracture, crystal growth and imperfections, stress, corrosion, etc.;
- d. Develop techniques for measurement of the properties of materials under carefully controlled conditions including extremes of high and low temperature and pressure and exposure to different types of radiation and environmental conditions;
- e. Assist in the development of standard methods of measurement and equipment for evaluating the properties of materials;

- f. Conduct research and development methodology leading to the production of standard reference materials, and produce these materials;
- g. Provide advisory services to Government, industry, universities, and the scientific and technological community on problems related to materials;
- h. Assist industry and national standards organizations in the development and establishment of standards; and
- i. Cooperate with and assist national and international organizations engaged in the development of international standards.

#### SECTION 11. INSTITUTE FOR APPLIED TECHNOLOGY.

.01 The Institute for Applied Technology shall provide technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperate with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provide technical advice and services to Government agencies upon request. The Institute shall also monitor NBS engineering standards activities and provide liaison between NBS and national and international engineering standards bodies.

.02 The Director shall direct the development, execution, and evaluation of the programs of the Institute. The Deputy Director shall assist in the direction of the Institute and perform the functions of the Director in the latter's absence.

.03 The Office of Weights and Measures shall provide technical assistance to the States with regard to model laws and technical regulations, and to the States, business, and industry in the areas of testing, specifications, and tolerances for weighing and measuring devices, to design, construction, and use of standards of weight and measure of associated instruments, and the training of State and local weights and measures officials. The office includes the Master Railway Track Scale Depot, Clearing, Illinois.

.04 The Office of Engineering Standards Services shall cooperate with and assist producers, distributors, users and consumers of products, and agencies of the Federal, State and local governments in the development of standards for products; develop safety standards required by statute; conduct appropriate sampling, testing and evaluation; and provide information services with respect to engineering standards.

.05 The Office of Flammable Fabrics shall conduct research into the flammability of products, fabrics, and materials; conduct feasibility studies on reduction of flammability of products, fabrics, and materials; develop flammability test methods and testing devices; offer appropriate training in the use of flammability test methods and testing devices; and carry out research and investigation to determine what flammability standards and regulations are needed and should be issued by the Secretary of Commerce.

.06 The Office of Invention and Innovation shall analyze the effect of Federal laws and policies (e.g., tax, anti-trust, and regulatory policies) on the national climate for invention and innovation; undertake studies in related areas with other agencies; and assist and encourage inventors through inventors' services and programs, including cooperative activities with the States.

.07 The Office of Vehicle Systems Research, as mutually agreed upon by the Bureau and the National Highway Safety Bureau, shall perform for the latter, or under contract or grant obtains the performance of, the research, development, testing and evaluation necessary to provide the technical basis for Federal safety standards for motor vehicles and motor equipment; develop methods of testing to determine compliance with these standards; and perform other related services.

.08 The Building Research Division shall develop criteria for performance standards of building products, structures, and systems; and cooperate with industry, other Government agencies, and the professional associations of the industry in the development of standards and measurement.

.09 The Electronic Technology Division shall develop criteria for the evaluation of products and services in the general field of electronic instrumentation; cooperate with appropriate public and private organizations in identifying needs for improved technology in this field; and cooperate in the development of standards, codes and specifications. Further, it shall apply the technology of electronic instrumentation to the development of methods of practical measurement of physical quantities and properties of materials.

.10 The Technical Analysis Division shall conduct benefit-cost analyses and other basic studies required in planning and carrying out programs of the Institute. This includes the development of simulations of industrial systems and of Government interactions with industry, and the conduct of studies of alternative Institute programs. On request, the Division shall provide similar analytic services for other programs of the Department of Commerce, in particular, those of the science-based bureaus, and, as appropriate, for other agencies of the executive branch.

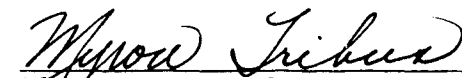
.11 The Product Evaluation Technology Division shall develop the technology, standards, and test methods for evaluating products including their systems, components, and materials.

.12 The Measurement Engineering Division shall serve the Bureau in an engineering consulting capacity in measurement technology; and provide technical advice and apparatus development supported by appropriate research, especially in electronics, and in the combination of electronics with mechanical, thermal, and optical techniques.

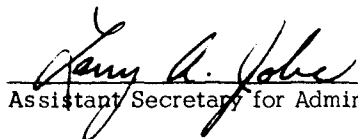
SECTION 12. EFFECT ON OTHER ORDERS.

This order supersedes Department Organization Order 30-2B of September 30, 1970, except that Appendix A of March 14, 1969, is not superseded.

  
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Director, National Bureau of Standards

  
\_\_\_\_\_  
Assistant Secretary for Science and  
Technology

Approved:


  
\_\_\_\_\_  
Assistant Secretary for Administration

APPENDIX D

USNO Organizational Location

Contents:

Executive Order 9126, April 1942;  
Reorganization Plan No. 3, May 1946.



**EXECUTIVE ORDER 9126**

**TRANSFERRING COGNIZANCE OF THE DUTIES  
AND FUNCTIONS OF THE HYDROGRAPHIC  
OFFICE AND THE NAVAL OBSERVATORY  
FROM THE BUREAU OF NAVIGATION, NAVY  
DEPARTMENT, TO THE CHIEF OF NAVAL  
OPERATIONS**

By virtue of the authority vested in me by Title I of the First War Powers Act, 1941, approved December 18, 1941 (Public Law 354, 77th Congress), and for the more effective exercise and more efficient administration of my powers as Commander in Chief of the Army and Navy, it is hereby ordered as follows:

1. The duties and functions of the Hydrographic Office and Naval Observatory, Bureau of Navigation, Navy Department, are hereby transferred to the cognizance and jurisdiction of the Chief of Naval Operations under the direction of the Secretary of the Navy.

2. All personnel, together with the whole of the records and public property now under the cognizance of the Bureau of Navigation in the Hydrographic Office and the Naval Observatory are assigned and transferred to the Office of Chief of Naval Operations.

**FRANKLIN D ROOSEVELT**

**THE WHITE HOUSE,**

*April 8, 1942.*

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## 118 Special Message to the Congress Transmitting Reorganization Plan 3 of 1946. May 16, 1946

*To the Congress of the United States:*

I transmit herewith Reorganization Plan No. 3 of 1946, prepared in accordance with the provisions of the Reorganization Act of 1945.

The Plan contains reorganizations affecting a number of departments and establishments. Some continue on a permanent basis changes made by Executive order under authority of the First War Powers Act. A few make adjustments in the distribution of functions among agencies. The remainder deal with problems of organization within individual agencies. All are concerned with improving and simplifying particular phases of Government administration.

Each proposal is explained in more detail under the appropriate heading below.

I have found, after investigation, that each reorganization contained in the Plan is necessary to accomplish one or more of the purposes set forth in section 2(a) of the Reorganization Act of 1945.

### DEPARTMENT OF THE TREASURY

The functions of the Bureau of Marine Inspection and Navigation were transferred from the Department of Commerce to the Coast Guard and the Bureau of Customs in 1942 by Executive order under the First War Powers Act. This arrangement has been proved successful by the experience of the past four years. Part I of the Reorganization Plan continues the arrangement on a permanent basis.

#### *United States Coast Guard*

The principal functions of the Bureau of Marine Inspection and Navigation were those of the inspection of vessels and their

equipment, the licensing and certifying of officers and seamen, and related functions designed to safeguard the safety of life and property at sea. Thus these functions are related to the regular activities and general purposes of the Coast Guard. The Coast Guard administered them successfully during the tremendous expansion of wartime shipping, by virtue of improvements in organization and program, many of which ought to be continued.

The Plan also transfers to the Coast Guard the functions of the Collectors of Customs relating to the award of numbers to undocumented vessels. These functions, too, were temporarily transferred to the Coast Guard in 1942.

#### *Bureau of Customs*

The Plan transfers to the Commissioner of Customs the functions of the Bureau of Marine Inspection and Navigation and the Secretary of Commerce relating to the documentation of vessels, measurement of vessels, administration of tonnage tax and tolls, entry and clearance of vessels and aircraft, regulation of coastwise trade and fisheries, recording of conveyances and mortgages of vessels, and protection of steerage passengers. These functions have always been performed at the ports by the Customs Service, although legal responsibility for their supervision was vested in the Bureau of Marine Inspection and Navigation and the Secretary of Commerce until transferred temporarily to the Commissioner of Customs under the wartime reorganization power.

The proposed transfer will permit more efficient administration by ending divided responsibility.

DEPARTMENT OF WAR AND DEPARTMENT OF  
THE NAVY

*Functions with Respect to Certain Insane  
Persons*

Prior to World War I practically all mental patients for whom the Federal Government was legally obligated to provide hospital care and treatment, including personnel of the armed forces, were hospitalized in St. Elizabeths Hospital, Washington, D.C. In addition, this hospital served as the mental hospital for the District of Columbia Government. Following World War I, the responsibility for hospital care of mentally ill war veterans was assigned to the Veterans Administration. Somewhat later, specialized hospital facilities were provided by the Bureau of Prisons of the Department of Justice to enable that agency to care for prisoners suffering from mental disorders.

With the growth in the population of the District of Columbia and the wartime expansion of the armed forces, the facilities of St. Elizabeths Hospital became inadequate. The War Department therefore established its own mental hospitals at the outset of World War II. Furthermore it became necessary a year ago for the Navy Department to discontinue the use of St. Elizabeths and to assume the responsibility for the care of its mental patients.

Since the return of the Coast Guard to the Treasury Department, the Public Health Service now provides care in its mental hospitals for personnel of the Coast Guard in accordance with the basic responsibility delegated to it in the Public Health Service Code enacted in 1944. The Plan abolishes the functions of St. Elizabeths Hospital with respect to insane persons belonging to the Coast Guard which are provided for by Sec. 4843 of the Revised Statutes (24 U.S.C. 191).

Responsibility for the care of mental patients has been allocated on the basis of the four broad categories of beneficiaries, namely, (1) veterans, to be cared for by the Veterans Administration; (2) military and naval personnel, to be cared for by the War and Navy Departments; (3) prisoners, for whom the Department of Justice will be responsible; and (4) other civilians, to be cared for by the Federal Security Agency. The Reorganization Plan, in order to carry out this policy, provides for the transfer or abolition of certain functions and legal responsibilities now resting with the Federal Security Administrator and Superintendent of St. Elizabeths Hospital.

NAVY DEPARTMENT

*Hydrographic Office and Naval Observatory*

The Plan transfers the Hydrographic Office and the Naval Observatory from the Bureau of Naval Personnel to the Office of the Chief of Naval Operations. The Plan would confirm and make permanent the action taken in 1942 by Executive Order No. 9126 under the First War Powers Act.

The functions performed by both the Hydrographic Office and the Naval Observatory relate primarily to operational matters and thus are more appropriately placed in the Office of the Chief of Naval Operations than in the Bureau of Naval Personnel. This fact was recognized in the realignment of naval functions at the outbreak of the war. The Plan merely confirms an organizational relationship which has existed successfully for the past four years.

*Supply Department of the United States  
Marine Corps*

The Plan consolidates the Paymaster's Department and the Quartermaster's Department of the United States Marine Corps into

a single Supply Department. This consolidation will establish in the Marine Corps an integrated supply organization which parallels that of the Navy Department's Bureau of Supplies and Accounts.

The consolidation will make possible a more efficient and more economical organization of the companion functions of supply and disbursement, eliminating the present handling of related items by two separate departments of the Corps.

#### DEPARTMENT OF THE INTERIOR

##### *The Franklin D. Roosevelt Library at Hyde Park*

At the present time, the National Park Service, the Public Buildings Administration, and the Archivist of the United States all perform "housekeeping" functions at the Franklin D. Roosevelt Library and home at Hyde Park. The Plan unifies in the National Park Service responsibility for activities of this character at Hyde Park—that is, the maintenance and protection of buildings and grounds, the collection of fees, and the handling of traffic and visitors. Because of its wide experience in the administration of historic sites, the National Park Service is the logical agency to assume the combined functions.

Transfer of these functions does not affect the responsibility of the Archivist for the contents and professional services of the Library proper. It also does not affect the present disposition of the receipts, which is provided by law.

##### *Functions Relating to Mineral Deposits in Certain Lands*

The Plan transfers to the Department of the Interior jurisdiction over mineral deposits on lands held by the Department of Agriculture.

The Department of the Interior now administers the mining and mineral leasing laws on various areas of the public lands, including those national forests established on parts of the original public domain. The Department of Agriculture, on the other hand, has jurisdiction with respect to mineral deposits on (1) forest lands acquired under the Weeks Act, (2) lands acquired in connection with the rural rehabilitation program, and (3) lands acquired by the Department as a part of the Government's effort to retire submarginal lands.

Accordingly this Reorganization Plan provides that these mineral deposits on lands of the Department of Agriculture will be administered by the Department of the Interior, which already has the bulk of the Federal Government's mineral leasing program.

The Plan further provides that the administration of mineral leasing on these lands under the jurisdiction of the Department of Agriculture will be carried on subject to limitations necessary to protect the surface uses for which these lands were primarily acquired.

##### *Bureau of Land Management*

The Plan consolidates the General Land Office and the Grazing Service of the Department of the Interior into a Bureau of Land Management.

The General Land Office and the Grazing Service now divide responsibility for the major portion of the multiple-use Federally-owned lands now held by the Department of the Interior. The lands under jurisdiction of the two agencies are comparable in character and in use. In some functions, the two agencies employ the same type of personnel and use the same techniques. Other functions are divided between the agencies so that both are engaged in management of



various aspects of the same land. Consolidating these two agencies will permit the development of uniform policies and the integration of two organizations whose responsibilities now overlap.

Integration of the activities of the two agencies will make possible greater utilization and thus more economic use of expert skills. The same practical experience embraced in range administration on public lands in grazing districts will be available for public lands outside the districts.

Utilization of lands within grazing districts for non-grazing purposes will be subject to only one classification examination, rather than dual examination as is now necessary. Economy will be possible in the construction of range improvements, wherever feasible, to serve lands both in and out of districts. Legal procedures such as adjudication of issues relating to licenses and leases, hearings on appeal from administrative decisions, and the processing of trespass cases will benefit from unified administration and handling.

In such activities as fire protection, soil and moisture conservation, management of public lands under agreement with other agencies (e.g., Bureau of Reclamation), range surveys, maintenance and improvement of stock driveways, and stabilization of range use on all public domain, the benefits of consolidation will become increasingly apparent. Further, records relating to grazing lands can be concentrated in fewer field offices and hence administered more effectively.

While the establishment of a new Bureau of Land Management under a Director involves the abolition of the Commissioner and Assistant Commissioners of the General Land Office, the Director and Assistant Directors of Grazing, the Registers of District Land Offices, and the United States

Supervisor of Surveys, the statutory functions now discharged by these officers are in no way modified. This plan will place final responsibility for these functions in the Secretary of the Interior and make him responsible for their performance in coordination with the other land activities of his Department. Officers whose offices are specifically abolished, but whose experience will make them valuable to the Department, should be available for appointment in the new Bureau.

I have found and declare that by reason of the reorganization made by the Plan the responsibilities and duties of the Bureau of Land Management are of such nature as to require the inclusion in the Plan of provisions for the appointment and compensation of a Director, an Associate Director, and Assistant Directors.

#### DEPARTMENT OF AGRICULTURE

##### *Functions of Certain Agencies of the Department of Agriculture*

To enable the Department of Agriculture to meet its responsibilities for food production and distribution during the war, there was early and continuing coordination of its programs directly concerned with these phases of the food problem. Beginning with Executive Order No. 9069 of February 23, 1942, those programs and agencies dealing with food production and distribution were gradually consolidated by a series of Executive orders issued under the authority of the First War Powers Act. By Executive Order No. 9934 of April 19, 1943, they were all grouped into a War Food Administration, under a War Food Administrator.

When the fighting was drawing to a close and the emergency purposes of the War Food Administration had been largely accomplished, this Administration was ter-

minated by Executive Order No. 9577 of June 29, 1945; and its functions and agencies were transferred back to the jurisdiction of the Secretary of Agriculture. Executive Order No. 9577 also authorized the Secretary of Agriculture to organize and administer the transferred functions and agencies in the manner which he deemed best.

Under this authority, the Secretary established the Production and Marketing Administration in August 1945. Into this Administration, he consolidated the functions of many of the production and marketing agencies which were transferred back from the War Food Administration. Included were the functions of the Agricultural Adjustment Administration and the Surplus Marketing Administration and the administration of the programs of the Federal Crop Insurance Corporation and the Commodity Credit Corporation.

The Plan transfers these functions to the Secretary of Agriculture in order to permit him to continue the consolidation already effected in the Production and Marketing Administration. This provision makes it possible to maintain the close coordination and integration of food production and distribution programs, with the resulting benefits that were achieved during the war. It also provides the Secretary with the necessary flexibility to make adjustments in the coordination and administration of these programs to meet changing conditions and new problems, a flexibility which he particularly needs at this period of acute food shortages throughout the world.

#### DEPARTMENT OF COMMERCE

##### *Certain Functions of National Bureau of Standards*

The Plan transfers the functions of two divisions of the National Bureau of Stand-

ards in the Department of Commerce, namely, the Division of Simplified Trade Practices and the Division of Commercial Standards, to the Secretary of Commerce. The transfer will permit the Secretary to reassign these functions to the Office of Domestic Commerce, which is the focal point of the Department's general service functions for American business.

These two divisions were established as a result of the standardization work initiated in World War I. Both divisions have followed the same basic procedure of assisting the producers and the consumers of particular products to agree among themselves on certain standards or on a certain limited number of varieties. Each such voluntary agreement is then published by the National Bureau of Standards and, although not compulsory, has tended to become the generally accepted practice in the trade.

Standardization again proved to be an important device for accelerating production in World War II; and industry has shown renewed interest in continuing these wartime conservation and rationalization programs on a voluntary basis in the production of peacetime products.

The desirability of the proposed transfer was emphasized only a few months ago by the report of a committee of prominent businessmen appointed by the Secretary of Commerce to review the entire question of the Government's activities in this field. These studies indicate that two major benefits will result from the transfer.

First, the association of the two divisions with the National Bureau of Standards has perhaps tended to give the impression in some quarters that voluntary standards and trade practices worked out by industry with the help of these two divisions are in some sense Government standards which are enforced on the basis of scientific and objective

tests. The transfer of these two divisions to the Department proper would reduce any such misconceptions, and make it clear that these standards and simplified practices are voluntary industry agreements in the making of which the Government acts merely in an advisory capacity.

Second, the other general services of the Department to American business, such as marketing, management, and economic and statistical services, are now concentrated in the Office of Domestic Commerce. The association of these two divisions with these other services to business will facilitate their work and enable them to make use of the wide industrial and business contacts of the Office of Domestic Commerce.

#### NATIONAL LABOR RELATIONS BOARD

##### *Strike Ballots Under the War Labor Disputes Act*

The Plan abolishes the function of conducting strike ballots which was vested in the National Labor Relations Board by Section 8 of the War Labor Disputes Act (57 Stat. 167, ch. 144). Experience indicates that such elections under the act do not serve to reduce the number of strikes and may even aggravate labor difficulties. The Congress has already forbidden the Board to expend any of its appropriations for the current fiscal year for this activity (First Deficiency Appropriation Act of 1946). I believe that the function should now be permanently abolished.

#### SMITHSONIAN INSTITUTION

##### *Canal Zone Biological Area*

The Plan transfers responsibility for the Canal Zone Biological Area to the Smithsonian Institution. At present, the Canal Zone Biological Area is an independent

agency of the Government, having as its function the administration of Barro Colorado Island in Gatun Lake as a tropical wildlife preserve and research laboratory. The Board of Directors of this agency consists of the President of the National Academy of Sciences as Chairman, the Secretary of the Smithsonian Institution, three members of the Cabinet—the Secretaries of War, Interior, and Agriculture—and three biologists.

The transfer will locate this function with comparable and related functions already assigned to the Smithsonian Institution whose staff members have participated since the beginning in developing the island as a research center. It will reduce by one the number of Government agencies. It will relieve three Cabinet members of routine duties not important enough to warrant their personal attention.

Under its existing authority the Smithsonian Institution may constitute an advisory board of biologists and departmental representatives if it finds such action necessary.

#### UNITED STATES EMPLOYMENT SERVICE

##### *Placement Functions Under Selective Training and Service Act of 1940*

The Plan transfers to the United States Employment Service the functions of the Selective Service System and its Director with respect to assisting ex-servicemen in obtaining new positions. These functions directly overlap the regular placement activities of the United States Employment Service, which is required to provide a special placement service for veterans both by its basic act and by the Servicemen's Readjustment Act of 1944. The transfer is in line with the policy of the Congress on the placement of veterans as most recently expressed in the 1944 Act. The shift will prevent

needless duplication of personnel and facilities and will assure the best service to veterans.

HARRY S. TRUMAN

NOTE: Reorganization Plan 3 of 1946 is published in the U.S. Statutes at Large (60 Stat. 1097) and in the 1943-1948 Compilation of title 3 of the Code of Federal Regulations (p. 1065). It became effective July 16, 1946.

## 119 The President's Regular News Conference of May 16, 1946

THE PRESIDENT. [1.] The members of the Philippine War Damage Commission are: Frank A. Waring of California, John S. Young of New York, and Francisco A. Delgado [Delgado] of the Philippine Islands.

[2.] And I think I had better read you a statement on the draft bill, copies of which will be available for you when you go out.

"As I have already said, the Draft Extension Act is bad legislation. I signed it reluctantly,<sup>1</sup> and only because of my conviction that conditions would be worse without it. The act at least has the merit of keeping intact the draft machinery and of preserving for the time being the reemployment rights of veterans.

"It is to be hoped that before July 1st, when the present extension expires, the Congress will extend Selective Service for a year in a form that will meet the Nation's requirements.

"General Hershey informs me that the exemption of 18- and 19-year-old registrants will reduce the number of men who can be inducted into the Armed Forces each month, in the age group under 26, from approximately 35,000 to approximately 5,000.

<sup>1</sup> On May 14 the President approved a bill extending the Selective Training and Service Act of 1940, as amended, until July 1, 1946 (Public Law 379, 79th Cong., 60 Stat. 181). On June 29 he approved a bill further extending the act (Public Law 473, 79th Cong., 60 Stat. 341).

Eighty thousand physically and mentally acceptable 18- and 19-year-old high school students whose inductions had been postponed are now lost to the Armed Forces.

"It will be noted that Congress has restricted inductions, except of volunteers, to the age group who become 20 or who were between 20 and 30 at the time fixed for their registration. Seemingly, it was the intent of Congress to include only those who are now under 30, but the clear words of the law include as liable all men born on or subsequent to October 17, 1910, who have reached the age of 20. Thus, men up to 35 years, 7 months of age could be drafted. I cite this fact just to illustrate how loosely drawn is this law. As another example, there is nothing in the law to prohibit the reinduction of men of eligible age who have already had their war service and been discharged.

"Of course, there is no intention to draft men up to the age of 35 years, 7 months. The War Department does not want men over 30, and men over that age will not be reclassified.

"I am, however, authorizing the Secretary of War and the Secretary of the Navy to call upon the Director of Selective Service for the induction of men who become 20 and who will not have reached the age of 30 on the date of their induction. Under present regulations, the top limit is 26. We must save what we can from the near-

wreckage of the Selective Service System."

Copies of that will be available for you when you go out.

[3.] I have here some reorganization plans—three reorganization plans—which I have sent down to the Congress this afternoon. All detailed and set out in short form—which will be handed to you.

The first reorganization plan confirms the transfer to the Department of State of the Office of Inter-American Affairs, already made by Executive order of the 10th of April.

The Office of the United States High Commissioner of the Philippines is abolished—its affairs to be liquidated by the Department of State, because the Philippines become independent July 4th.

Treasury Department—confirms the transfer by the Executive order of 1943, from Justice to the Treasury, of certain minor functions.

Then the Department of Agriculture functions of eight research bureau agencies, consolidated by an Executive order of 1942 in Agricultural Research, are transferred to the Secretary of Agriculture.

The Office of War Mobilization and Reconversion, Contract Settlement, is transferred to OWMR and abolished.

National Housing Agency—consolidated permanently in one agency the main housing activities of the Government. Lack of permanent status has handicapped NHA operations—fully recognize that the Wagner-Ellender-Taft bill, S.1592, approved by the Senate in April, and now pending in the House, provides, among other things, for a permanent housing organization along the same line. This reorganization follows along the Wagner-Ellender-Taft bill.

Federal Deposit Insurance Corporation—makes permanent transfer to FDIC, by Executive order of 1942.

Then the second reorganization plan follows along the same lines, as does the third one.

All these reorganization plan things will be available for you after the press conference, as many as want them.

These are all the announcements I have to make.

[4.] Q. Mr. President, can we retrace a little your draft statement? What that means is that now you are authorizing Selective Service, through the War and Navy Departments, to draft men between 20 and 30?

THE PRESIDENT. That's correct. That's correct.

Q. That abolishes the present limit of 26—

THE PRESIDENT. That's correct. It will have to be done, if we are—

Q. —to 26—

THE PRESIDENT. —20—18 to 26—

Q. —before the—

THE PRESIDENT. Before the law—

Q. But under the extension—

THE PRESIDENT. Under the extension, the way it is now, we wouldn't get anybody, to speak of. So we have got to arrange some way to get men to fill the necessary requirements of the War and Navy Departments.

Q. Do you know approximately how many men will be available?

THE PRESIDENT. I do not. We haven't had time to make a survey.

[5.] Q. Mr. President, I understand that the railroad negotiations have broken down. Are you—

THE PRESIDENT. No. We are still working on that. I have nothing to say about that at this time. Still working on it.

Q. John D. Small, Civil Production man, has called for legislation outlawing strikes for the next 6 months at least. I was just

APPENDIX E

Official Mission and Functional Statements for USNO

Contents:

Mission of USNO;

Mission and Functions Assigned to the USNO.



THE UNITED STATES NAVAL OBSERVATORY  
MISSION

"Make such observations of celestial bodies, natural and artificial, derive and publish such data as will afford to United States Naval vessels and aircraft as well as to all availing themselves thereof, means for safe navigation, including the provision of accurate time; and while pursuing this primary function, contribute material to the general advancement of navigation and astronomy."

10 01 669

Mission and Functions of the  
U. S. Naval Observatory

Mission: To make such observations of celestial bodies, natural and artificial, derive and publish such data as will afford to United States Naval vessels and aircraft as well as to all availing themselves thereof, means for safe navigation, including the provision of accurate time; and while pursuing this primary function, contribute material to the general advancement of navigation and astronomy.

Functions: In carrying out this mission, the Superintendent, U. S. Naval Observatory, shall perform the following functions:

1. Supervise and direct all functions, programs, and activities of the U. S. Naval Observatory, and command shore activities as assigned by the Chief of Naval Operations.
2. Recommend policies, plans, and programs deemed necessary or appropriate to promote the operational effectiveness or efficiency of the Naval Observatory.
3. Make continuous observations of the sun, moon, planets, stars, and other celestial bodies, natural and artificial, to determine their positions and motions.
4. Compile and publish the astronomical publications required for safe navigation and fundamental positional astronomy.
5. Derive, maintain and coordinate precise time and time interval (frequency), both astronomical and atomic, for the Department of Defense; and control distribution of, and provide single management service and interservice support for precise time and time interval within the Department of Defense.
6. Collaborate worldwide with astronomers through the exchange of astronomical data in order to obtain information required for the publications of the Naval Observatory.
7. Contribute to the advancement of astronomy and navigation by the conduct of research in celestial mechanics and astronomy and the publication of the results thereof.
8. Discharge other responsibilities which may be assigned by the Chief of Naval Operations.

Enclosure (1)



APPENDIX F  
USNO Responsibilities

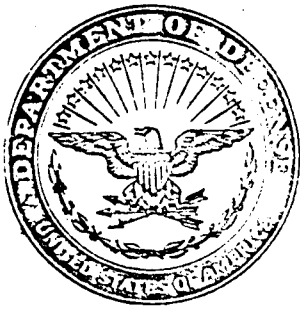
Contents:

DoD Directive 5160.51, August 31, 1971;

Secnavinst 4120.15A, March 1, 1971;

Secnavinst 4120.16, October 24, 1966.





August 31, 1971  
NUMBER 5160.51

ATSD(T)

## Department of Defense Directive

**SUBJECT** Precise Time and Time Interval (PTTI) Standards and Calibration Facilities for Use by Department of Defense Components

- Refs.:**
- (a) DoD Directive 5160.51, "Time and Time Interval Standards and Calibration Facilities for Use by Department of Defense Components," February 1, 1965 (hereby cancelled)
  - (b) DoD Instruction 4630.4, "Support and Management Services for Precise Time and Time Interval Standards," June 22, 1966 (hereby cancelled)
  - (c) DoD Directive 4000.19, "Basic Policies and Principles for Interservice and Interdepartmental Logistic Support," August 5, 1967

### I. REISSUANCE

This Directive reissues reference (a) and consolidates references (a) and (b) which are hereby cancelled. Revisions occasioned by organizational and administrative changes are also included. There are no substantive changes.

### II. PURPOSE AND APPLICABILITY

This Directive establishes policy and assigns responsibility to a single Department of Defense Component for establishing, coordinating, and maintaining capabilities for time and time interval (astronomical and atomic) for use by all DoD Components, DoD contractors, and related scientific laboratories.

### III. DEFINITIONS

For purposes of this Directive, the following definitions will apply.

Continuation of III.

- A. Time signifies epoch, that is, the designation of an instant on a selected time scale, astronomical or atomic. It is used in the sense of time of day.
- B. Time Interval indicates the duration of a segment of time without reference to when the time interval begins and ends. Time interval may be given in seconds of time.
- C. Standards signifies the reference values of time and time interval. These standards are determined by astronomical observation and by the operation of atomic clocks. They are disseminated by transport of clocks, radio transmissions, and by other means.
- D. Precise Frequency signifies a frequency requirement to within one part in  $10^9$  of an established time scale.
- E. Precise Time signifies a time requirement within ten milliseconds.

IV. POLICY

- A. Resources for uniform and standard time and time interval operations and research shall be the responsibility of a single DoD Component.
- B. The maximum practicable interchange of time and time interval information shall be effected throughout the DoD.
- C. Maximum practical utilization of interservice support will be achieved as prescribed in reference (c).

V. RESPONSIBILITIES

- A. The U. S. Naval Observatory (hereafter referred to as the "Observatory") is assigned the responsibility for insuring:
  - 1. Uniformity in precise time and time interval operations including measurements.
  - 2. The establishment of overall DoD requirements for time and time interval.

Continuation of V.

3. The accomplishment of objectives requiring precise time and time interval with minimum cost.
- B. In carrying out the above responsibilities, the Observatory shall:
1. Derive and maintain standards of time and time interval, both astronomical and atomic.
  2. Provide coordination of such standards with recognized national and international standards to insure world-wide continuity of precision.
  3. Monitor conferences concerning time and time interval standards.
  4. Advise and provide guidance to DoD Components, contractors, and scientific laboratories on matters concerning time and time interval, and their measurement.
- C. All DoD Components which require, utilize, or distribute time and time interval information or have a need for a specific time scale shall:
1. Refer time and time interval to the standards established by the Observatory.
  2. Maintain specific time scales such that relationship to the standard established by the Observatory is known.
  3. Prescribe technical requirements for the coordination of techniques, procedures and periodic calibrations of systems.
  4. Promote economy by prescribing requirements for precise time that are consistent with operational and research needs for accuracy.

## VI. DELINEATION OF FUNCTIONS

- A. The Observatory is the single DoD Component responsible for PTTI management control functions. This responsibility encompasses overall activities requiring time to within ten milliseconds and frequency to within one part in  $10^9$  of an established time scale. In carrying out these PTTI functions on a common-servicing basis, the Observatory will:
1. Issue detailed information concerning reference values for PTTI and distribute them by means of controlled radio transmissions and portable atomic clocks.
  2. Promote (a) operational uniformity of PTTI functions, including measurements; (b) establishment of overall DoD PTTI requirements; and (c) accomplishment of objectives requiring PTTI at minimum cost.
  3. Monitor DoD research programs concerning PTTI (frequency), in coordination with the Office of the Director of Defense Research and Engineering.
  4. Review (a) existing and future PTTI (frequency) requirements of the DoD user components in order to establish overall DoD requirements and to provide adequate supporting services; and (b) existing PTTI operations conducted by DoD user components to provide guidance and recommendations to the Assistant to the Secretary of Defense (Telecommunications).
  5. Establish relationships between the DoD and other Federal Government agencies on PTTI matters.
  6. Provide advice and guidance concerning requests for unilateral PTTI (frequency) programs at the direction of Assistant to the Secretary of Defense (Telecommunications).
  7. Participate in PTTI policy negotiations between the DoD and other Federal Government agencies and international organizations.

Continuation of VI. A.

8. Maintain records of PTTI (frequency) arrangements between the DoD and its contractors and other Federal Government agencies, with the exception of radio frequency assignments.

B. DoD User Components

1. DoD Components presently conducting Precise Time and Time Interval operations and research may continue these activities unless otherwise instructed by the Assistant to the Secretary of Defense (Telecommunications).
2. The Military Departments will assist the Observatory by (a) providing technical information on current and prospective programs involving PTTI applications; and (b) distributing, monitoring and controlling PTTI services on request, subject to the provisions of this Directive and the availability of funds.

C. DoD User Components and contractors will:

1. Consult the Observatory on any technical and logistic problems arising from obtaining a particular accuracy through radio transmissions and portable atomic clocks.
2. Use DoD-controlled transmissions to the maximum extent practicable. Other transmissions of time and frequency which have been coordinated with the Observatory may be used when DoD transmissions do not provide adequate coverage.
3. Refer measurements and contract specifications to DoD standards determined by the Observatory.
4. Use techniques and procedures described in information documents issued by the Observatory in all cases where such documents satisfy the need.
5. Notify the Observatory of:
  - a. Existing and planned PTTI requirements, including information as to accuracy and stability of needs,

Continuation of VI. C. 5. a.

measurement techniques planned or in operation, and continuity of service required of the applicable distribution transmission.

- b. PTTI (frequency) arrangements between DoD user components and contractors and other Federal Government agencies (see paragraph VI. A. 8. above); and
  - c. Scheduled scientific and technical meetings on PTTI (frequency).
6. Consult the Observatory prior to entering into contracts for equipment, research, studies, or services involving PTTI (frequency) in order that maximum use of existing facilities may be assured.

VII. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. It shall be given full distribution by all DoD Components. Two copies of each implementing document shall be forwarded to the ATSD(T) within 90 days.



Deputy Secretary of Defense

copy #1



DEPARTMENT OF THE NAVY  
OFFICE OF THE SECRETARY  
WASHINGTON, D. C. 20350

SECNAVINST 4120.15A  
Op-09B6  
1 MAR 1971

SECNAV INSTRUCTION 4120.15A

From: Secretary of the Navy

Subj: Time and Time Interval Standards and Calibration  
Facilities for use by Department of the Navy.

Ref: (a) SECNAV Instruction 4355.11B of 16 Jul 1969 (D)

Encl: (1) DoD Directive 5160.51 of 1 Feb 1965

1. Purpose. To implement enclosure (1) within the Department of the Navy.

2. Cancellation. This Instruction supersedes and cancels SECNAV Instruction 4120.15 of 10 June 1965.

3. Scope and Applicability. The scope of this Instruction includes: the generation of operational and research requirements for precise time or time interval (frequency); the establishment, coordination, maintenance, distribution, and utilization of standard values for time and frequency; and the coordination of the Department of the Navy with other components of the Department of Defense with respect to precise time and frequency operations, techniques, procedures, measurements, and calibrations. As used in this Instruction, "precise time" means that the time is determined with respect to an established time scale to within 100 milliseconds; "precise frequency" means that the frequency is determined to within 1 part in 10<sup>9</sup> of an established time scale.

4. Policy

a. The epoch and the interval of time (frequency) as determined by the U. S. Naval Observatory shall be utilized as standards within the Department of the Navy.

b. Offices, bureaus, and laboratories requiring precise time and frequency shall make their requirements known to the U. S. Naval Observatory, and shall obtain its guidance as appropriate in preparing Specific Operational Requirements (SOR), Advanced Development Objectives (ADO), Proposed Technical Approaches (PTA), Technical Development Plans (TDP), and similar planning instruments.



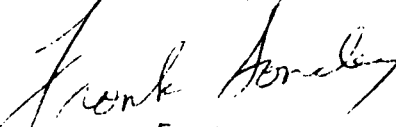
R) c. Designated naval facilities and systems which are capable of distributing precise time or frequency information, such as radio communications, satellites, and radio navigation systems, shall transmit the standards determined by the U. S. Naval Observatory.

d. Organizations with future requirements for precision or geographic coverage exceeding those provided by existing distribution systems shall make these requirements known to the U. S. Naval Observatory.

5. Responsibilities

R) a. The Chief of Naval Operations will designate and place operational requirements upon those naval facilities and systems which will transmit the time and frequency standards determined by the U. S. Naval Observatory. The Chief of Naval Operations also will provide and maintain suitable facilities to carry out the responsibilities assigned by enclosure (1).

R) b. The Chief of Naval Material, as directed by the Chief of Naval Operations and in accordance with reference (a), will coordinate compliance with enclosure (1).

  
Frank Sanders  
Assistant Secretary of the Navy  
(Installations and Logistics)

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DEPARTMENT OF THE NAVY  
OFFICE OF THE SECRETARY  
WASHINGTON, D. C. 20350

SECNAVINST 4120.16  
Op-09B6  
Ser 1257  
24 OCT 1966

SECNAV INSTRUCTION 412016

From: Secretary of the Navy  
To: Distribution List

Subj: Support and Management Services for Precise Time and  
Time Interval Standards

Ref: (a) SECNAV Instruction 4120.15 of 10 Jun 1965  
(b) SECNAV Instruction 4355.11A of 16 Jan 1962

Encl: (1) DoD Instruction 4630.4 of 22 Jun 1966

1. Purpose. To implement enclosure (1) within the Department of the Navy.

2. Scope and Applicability

a. The provisions of this Instruction apply to all Navy Components and Contractors requiring, using, or distributing Precise Time and Time Interval (PTTI), and cover all PTTI activities conducted within the Navy Department.

b. For purposes of this Instruction, "Precise Time and Time Interval" means time to within ten milliseconds and frequency to within one part in  $10^9$  of an established time scale.

c. Radio frequency assignments are not within the scope of this instruction.

3. Policy. It shall be the policy of the Department of the Navy that:

a. The responsibility for establishing, coordinating, and maintaining capabilities for Precise Time and Time Interval shall, in accordance with reference (a), reside with the Superintendent, U. S. Naval Observatory.

SECNAVINST 4120.16

24 October 1966

b. Navy Components and Contractors shall utilize as reference standards, the epoch and interval of time designated by the Superintendent, U. S. Naval Observatory.

c. Addressees shall insure that the provisions of enclosure (1) are effected immediately to the maximum extent practical and that future proposals, plans, agreements, contracts, studies, research efforts, and operational activities are in conformance with the provisions of enclosure (1).

4. Responsibilities

a. The Chief of Naval Operations will designate and place operational requirements upon those naval facilities and systems which will transmit the time and frequency standards determined by the Superintendent, U. S. Naval Observatory.

b. The Chief of Naval Material, as directed by the Chief of Naval Operations and in accordance with reference (b), will coordinate compliance with enclosure (1).

c. The Superintendent, U. S. Naval Observatory, shall establish and maintain suitable facilities to carry out the responsibilities assigned by enclosure (1).

*Robert H. Bellini*

DISTRIBUTION

(See Page 3)

APPENDIX G  
NBS/USNO Time Coordination

Contents:

- USNO Time Service Announcement, Series 14, No. 1;
- NBS Time & Frequency Services Bulletin, No. 132, Section 7;
- USNO Time Service Announcement, Series 14, No. 3;
- USNO Time Service Announcement, Series 7, No. 206.



U. S. NAVAL OBSERVATORY  
WASHINGTON, D.C. 20390

17 April 1968

TIME SERVICE ANNOUNCEMENT, Series 14

NO. 1

U. S. Naval Observatory Time Reference Stations

1. Precise time measurements against the Master Clock maintained by the U. S. Naval Observatory in Washington, D.C., may also be made at the locations listed below. Reference atomic clocks have been set up, or designated at these locations, and their time differences with the U. S. Naval Observatory Master Clock are measured regularly and are known to an accuracy of better than  $\pm 2.5$  microseconds.

Present locations of Time Reference Stations:

Master Clock:

U. S. Naval Observatory  
Time Service Division  
Washington, D. C. 20390

Tel: AITOVON  
Commercial: 202 696-8423  
TWX: 710 822 1970

Time Reference Stations:

(a) National Bureau of Standards  
Boulder, Colorado

Tel: FTS  
Commercial: 303 447-1000  
TWX:

(b) U. S. Naval Observatory Time Service Substation  
Miami (Perrine), Florida

Tel: Commercial: 305 235-0515  
TWX: 305 238 3451

(c) U. S. Navy Astronautics Group  
Detachment CHARLIE  
Wahiawa, Oahu, Hawaii

Tel: AUTOVON  
Commercial: 4315523  
TWX:

(d) U. S. Coast Guard Loran Monitoring Station  
Building 683  
Fuchu Air Station  
Fuchu-Shi, Tokyo-To, Japan

Tel: AUTOVON  
Commercial: 45700 or 47188  
TWX:

(e) Hewlett Packard Company  
Palo Alto, California

Tel: Commercial: 415 326-7000  
TWX: HEWPACK

(f) Hewlett Packard Company  
Geneva, Switzerland

Tel: Commercial: 022 42.81.50  
TWX: HEWPACKSA

2. Recent measurements are reported in the U. S. Naval Observatory Phase Value Bulletins and messages.

3. For further information, contact the:

Superintendent  
U. S. Naval Observatory  
Washington, D. C. 20390.

J. M. McDOWELL  
Superintendent

NATIONAL BUREAU OF STANDARDS  
TIME AND FREQUENCY DIVISION, BOULDER, COLORADO 80302

## 7. EXPLANATION OF NBS TIME SCALES

## AT(NBS)

-----  
AT(NBS) IS AN ATOMIC TIME SCALE, PREVIOUSLY CALLED NBS-A, WHOSE RATE IS DETERMINED BY THE PRIMARY FREQUENCY STANDARD OF THE NATIONAL BUREAU OF STANDARDS (NBSFS). THIS STANDARD (NBS-III CESIUM BEAM) DEFINES THE SECOND IN AGREEMENT WITH THE INTERNATIONAL SYSTEM OF UNITS (SI). THE EPOCH OF THE SCALE WAS IN AGREEMENT WITH UTC(NBS) AT 0000 UT 1 JAN 1958.  
-----

## SAT(NBS)

-----  
STEPPED ATOMIC TIME IS A COORDINATED TIME SCALE; I.E., THE INTERNATIONAL TIME BUREAU (BIH) DETERMINES WHEN STEPS IN EPOCH OF 0.2 S SHOULD OCCUR TO KEEP THIS SCALE IN APPROXIMATE AGREEMENT WITH UT2. THE RATE FOR THIS SCALE WAS THE SAME AS FOR AT(NBS) PRIOR TO 1 OCT 1968. THE NBS IN COOPERATION WITH THE UNITED STATES NAVAL OBSERVATORY (USNO) AGREED UPON A COORDINATE RATE STARTING 0000 UT 1 OCT 1968 FOR SAT(NBS), AND THIS RATE MAY BE WRITTEN PRESENTLY AS:

$$F[\text{COORDINATE}] = F[\text{NBSFS}](1 + 4 \text{ PARTS IN } 10 \text{ TO THE } 13\text{TH}).$$

IN OTHER WORDS, SAT(NBS) RUNS AT A RATE HIGHER IN FRACTIONAL FREQUENCY THAN AT(NBS) BY 4 PARTS IN 10 TO THE 13TH. SAT(NBS) IS THE TIME SCALE BROADCAST BY RADIO STATION WWVB. NOTE: THE DIFFERENCE IN RATE BETWEEN THESE SCALES IS RELEVANT ONLY TO INTERNATIONAL STANDARDS LABORATORIES AND OBSERVATORIES SUCH AS THE BIH, AND THIS IN NO WAY AFFECTS ALL OTHER USERS OF THIS TRANSMITTED SIGNAL.  
-----

## UTC(NBS)

-----  
UTC(NBS) IS A COORDINATED TIME SCALE; I.E., THE BIH DETERMINES WHEN STEPS IN EPOCH OF 0.1 S AND CHANGES IN RATE SHOULD OCCUR TO KEEP THIS UNIVERSAL TIME SCALE IN APPROXIMATE AGREEMENT WITH UT2. NEAR 1 OCT 1968 THE TIME DIFFERENCE, UTC(USNO) - UTC(NBS), WAS ZERO. THE NBS IN COOPERATION WITH THE USNO AGREED ON A COORDINATE RATE FOR THESE TWO TIME SCALES STARTING 0000 UT 1 OCT 1968. THE COORDINATE RATE WAS CHOSEN AS AN AVERAGE OF THE TWO RATES, AS DETERMINED BY PORTABLE CLOCKS, PRIOR TO 1 OCT 1968. THE USNO AND NBS INTEND TO MAINTAIN SYNCHRONIZATION OF THE UTC SCALES TO WITHIN ABOUT 3 MICROSECONDS BY USING THIS COORDINATE RATE. THE PRESENT COORDINATE RATE OF UTC(NBS) IS:

$$F[\text{UTC(NBS)}] = F[\text{COORDINATE}](1 - 300 \text{ PARTS IN } 10 \text{ TO THE } 10\text{TH})$$

OR

$$F[\text{UTC(NBS)}] = F[\text{NBSFS}](1 - 299.996 \text{ PARTS IN } 10 \text{ TO THE } 10\text{TH}).$$

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U. S. NAVAL OBSERVATORY  
WASHINGTON, D.C. 20390

8 October 1968

TIME SERVICE ANNOUNCEMENT, SERIES 14

NO. 3

Coordination of Clock Time Scales

1. In the interest of improved coordination between the National Bureau of Standards, the U. S. Naval Observatory, and international timekeeping centers, the frequency of the U. S. Naval Observatory clock time scales was lowered 4 parts in  $10^{13}$  on 1 October 1968 at 0<sup>h</sup> UT.
2. Effective 1 October 1968 all daily phase values and clock measurements published by the U. S. Naval Observatory will be given with respect to these improved coordinated time scales. Clocks which were running perfectly with respect to UTC(USNO) before 1 October 1968 will now show an apparent daily rate of 34.56 nanoseconds (fast).
3. For most timing applications this change will be insignificant since it is less than the random fluctuations of individual atomic clocks.

J. MAURY WERTH  
Superintendent



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U. S. NAVAL OBSERVATORY  
WASHINGTON, D.C. 20390

1971 December 9  
NO. 206

PRELIMINARY TIMES AND COORDINATES OF THE POLE, SERIES 7

I. Abbreviations and Constants.

BIH: Bureau International de l'Heure, Paris, France  
CIO: Conventional International Origin  
IAT: International Atomic Time  
NBS: National Bureau of Standards, Boulder, Co.  
NWL: U. S. Naval Weapons Laboratory, Dahlgren, Va.  
IPMS: International Polar Motion Service, Mizusawa-shi, Japan  
NOTSS: U. S. Naval Observatory Time Service Substation, Richmond, Fl.  
USNO: U. S. Naval Observatory Time Service, Washington, D. C.

JD = MJD + 2,400,000.5  
ET = IAT + 32.18s

DUT1 = UT1 - UTC  
= - 0.1s (January 1972)

Beginning 1 January 1972, the following formulas apply.

IAT - UTC(BIH) = 10.00000s  
IAT - A.1 = - 0.03439s

UTC(USNO) - UTC(BIH) = 0.00001s  
A.1 - UTC(USNO) = 10.0343817s

\*The Improved UTC system becomes effective 1 January 1972. UTC(USNO) will be retarded 0.107 600s on 31 December 1971, 23h 59m 60.107 600s (old UTC) so that at this instant the date will become 1 January 1972, 0h 0m 0s. At this same instant, the frequency offset of - 300 x 10<sup>-10</sup> will be eliminated. (For details, see Time Service Announcements, Series 14, Nos. 7 and 8.)

II. Extrapolated Corrections.

These predictions are based on values of UT2 derived from UT0 observations made at USNO and NOTSS. Linear curves are fitted to each station's unweighted, nightly results for 1, 2, and 3 months observations. The curves are extrapolated and combined into a single value. The estimated accuracy is about 5 ms. BIH corrections are used to obtain UT1 - UTC from UT2 - UTC.

Date Oh UT	MJD	UT2 - UT1		Extrapolated		Extrapolated	
		Unit = 0.0001s	UT1-UTC(USNO)	Unit = 0.001s	UT2 - UTC(USNO)	Unit = 0.001s	A.1-UTC(USNO)
1971 Dec. 16	41301	- 85	- 154	9.885 309 7s	- 162		
17	41302	- 82	- 155	9.887 901 7	- 163		
18	41303	- 80	- 155	9.890 493 7	- 163		
19	41304	- 77	- 156	9.893 085 7	- 164		
20	41305	- 75	- 156	9.895 677 7	- 164		
21	41306	- 73	- 158	9.898 269 7	- 165		
22	41307	- 70	- 158	9.900 861 7	- 165		

III. USNO Time Scales.

There is a frequency offset between UTC(USNO) and the independent local time, UTC(MEAN), in order to ensure the synchronism of UTC(USNO) and UTC(NBS) within  $\pm 5 \mu\text{s}$ . We have, therefore,

$$\text{UTC(USNO)} = \text{UTC(MEAN)} + \Delta f/f$$

where  $\Delta f/f = - 3 \times 10^{-13}$  since 1 October 1971.

UTC(USNO MC) is the physical clock which is steered to coincide with UTC(USNO) as closely as possible.

PRELIMINARY TIMES AND COORDINATES OF THE POLE, SERIES 7 (Continued)

IV. Preliminary Emission Times for Signals from Coordinated Stations.

1971 December 8

UT0 - UTC = - 0.152s

UT2 - UTC = - 0.157s

UT1 - UTC = - 0.146s

The emission times in terms of UT are estimates based upon current PZI observations made at Herstmonceux, England, NOTSS, and USNO. The published value of UT0 - UTC is obtained from UT1 - UTC by correcting for the variation in longitude of Washington as given by the BIH.

V. Provisional Coordinates of the Instantaneous Pole (CIO).

A. BIH values:

1971 Dec 19	x = + 0".089	y = + 0".043
24	= + 0.070	= + 0.038

B. IPMS values:

1971.45	x = + 0".026	y = + 0".478
.50	= + 0.086	= + 0.482

C. NWL values:

1971 Nov. 29	x = + 0".143	y = + 0".079
Dec. 4	= + 0.128	= + 0.065

APPENDIX H  
Treaty of the Meter



**Metric Convention:** Signed at Paris, May 20, 1875; ratification advised by the Senate, May 15, 1878; ratified by the President, May 28, 1878; ratifications exchanged, August 2, 1878; proclaimed, September 27, 1878. As amended by the convention signed at Sevres, October 6, 1921; ratification advised by the Senate, January 5, 1923; ratified by the President, September 19, 1923; ratification of the United States, deposited with the Government of the French Republic, October 24, 1923; proclaimed, October 27, 1923.

His Excellency the President of the United States of America, His Majesty the Emperor of Germany, His Majesty the Emperor of Austria-Hungary, His Majesty the King of the Belgians, His Majesty the Emperor of Brazil, His Excellency the President of the Argentine Confederation, His Majesty the King of Denmark, His Majesty the King of Spain, His Excellency the President of the French Republic, His Majesty the King of Italy, His Excellency the President of the Republic of Peru, His Majesty the King of Portugal and the Algarves, His Majesty the Emperor of all the Russias, His Majesty the King of Sweden and Norway, His Excellency the President of the Swiss Confederation, His Majesty the Emperor of the Ottomans, and His Excellency the President of the Republic of Venezuela, desiring international uniformity and precision in standards of weight and measure, have resolved to conclude a convention to this effect, and have named as their plenipotentiaries the following:

Who, after having exhibited their full powers, which were found to be in good and due form, have agreed upon the following articles:

**Article 1.** The high contracting parties engage to establish and maintain, at their common expense, a scientific and permanent international bureau of weights and measures, the location of which shall be at Paris.

**Art. 2.** The French Government shall take all the necessary measures to facilitate the purchase, or, if expedient, the construction, of a building which shall be especially devoted to this purpose, subject to the conditions stated in the regulations which are subjoined to this convention.

**Art. 3.** The operation of the international bureau shall be under the exclusive direction and supervision of an international committee of weights and measures, which latter shall be under the control of a general conference for weights and measures, to be composed of the delegates of all the contracting Governments.

**Art. 4.** The general conference for weights and measures shall be presided over by the president for the time being of the Paris Academy of Sciences.

**Art. 5.** The organization of the bureau, as well as the formation and the powers of the international committee, and of the general conference for weights and measures, are established by the regulations subjoined to this convention.

**Art. 6.** The international bureau of weights and measures shall be charged with the following duties:

**First.** All comparisons and verifications of the new prototypes of the meter and kilogram.

Second. The custody of the international prototypes.

Third. The periodical comparison of the national standards with the international prototypes and with their test copies, as well as comparisons of the standard thermometers.

Fourth. The comparison of the prototypes with the fundamental standards of nonmetrical weights and measures used in different countries for scientific purposes.

Fifth. The scaling and comparison of geodesic measuring bars.

Sixth. The comparison of standards and scales of precision, the verification of which may be requested by governments or by scientific societies, or even by constructors or men of science.

**Art. 7.** After the committee shall have proceeded with the work of coordinating the measures relative to electric units and when the general conference shall have so decided by a unanimous vote, the bureau will have charge of the establishment and keeping of the standards of the electric units and their test copies and also of comparing with those standards, the national or other standards of precision.

The bureau is also charged with the duty of making the determinations relative to physical constants, a more accurate knowledge of which may be useful in increasing precision and further insuring uniformity in the provinces to which the above-mentioned units belong (article 6 and first paragraph of article 7).

It is finally charged with the duty of coordinating similar determinations effected in other institutions.

**Art. 8.** The international prototypes and standards and also their test copies shall be deposited in the bureau; access to the deposit shall be solely reserved for the international committee.

**Art. 9.** The entire expense of the construction and outfit of the international bureau of weights and measures, together with the annual cost of its maintenance and the expenses of the committee, shall be defrayed by contributions from the contracting states, the amount of which shall be computed in proportion to the actual population of each.

**Art. 10.** The amounts representing the contributions of each of the contracting States shall be paid at the beginning of each year, through the ministry of foreign affairs of France, into the *Caisse de dépôts et consignations* at Paris, whence they may be drawn as occasion may require, upon the order of the director of the bureau.

**Art. 11.** Those Governments which may take advantage of the privilege, open to every State, of acceding to this convention shall be required to pay a contribution, the amount of which shall be fixed by the committee on the basis established in article 9, and which shall be devoted to the improvement of the scientific apparatus of the bureau.

**Art. 12.** The high contracting parties reserve to themselves the power of introducing into the present convention, by common consent, any modifications the propriety of which may have been shown by experience.

**Art. 13.** At the expiration of twelve years this convention may be abrogated by any one of the high contracting parties, so far as it is concerned.

Any Government which may avail itself of the right of terminating this convention, so far as it is concerned, shall be required to give notice of its intentions one year in advance, and by so doing shall renounce all rights of joint ownership in the international prototypes and in the bureau.

#### Appendix No. 1, Regulations.

**Article 1.** The international bureau of weights and measures shall be established in a special building, possessing all the necessary safeguards of stillness and stability.

It shall comprise, in addition to the vault, which shall be devoted to the safe-keeping of the prototypes, rooms for mounting the comparators and balances; a laboratory, a library, a room for the archives, workrooms for the employés, and lodgings for the watchmen and attendants.

**Art. 2.** It shall be the duty of the international committee to acquire and fit up the aforesaid building and to set in operation the work for which it was designed.

In case of the committee's inability to obtain a suitable

building one shall be built under its directions and in accordance with its plans.

*Art. 3.* The French Government shall, at the request of the international committee, take the necessary measures to cause the bureau to be recognized as an establishment of public utility.

*Art. 4.* The international committee shall cause the necessary instruments to be constructed, such as comparators for the standards of line and end measures, apparatus for the determination of absolute dilatations, balances for weighing in air and in vacuo, comparators for geodetic measuring bars, etc.

*Art. 5.* The entire expense incurred in the purchase or construction of the building, and in the purchase and placing of the instruments and apparatus, shall not exceed 400,000 francs.

*Art. 6.* The annual appropriation for the international bureau consists of two parts, one of which is fixed, the other complementary.

The fixed part is, in principle, 250,000 francs, but on the unanimous vote of the committee may be raised to 300,000 francs. It is borne by all the States and autonomous colonies that adhered to the meter convention before the sixth general conference.

The complementary part is made up of contributions from the States and autonomous colonies that joined the convention after the aforesaid general conference. The committee is charged with the duty of drawing up on the motion of the director the annual budget, but without exceeding the amount computed in accordance with the provisions of the two paragraphs above. The budget is made known every year by means of a special financial report to the Governments of the high contracting parties.

If the committee find it necessary either to increase beyond 300,000 francs the fixed part of the annual appropriation or to modify the computation of the contributions as determined by article 20 of these regulations, it should lay the matter before the Governments so as to enable them to issue in good time the needed instructions to their delegates to the next general conference in order that the said conference may deliberate to good purpose. The decision will stand only in the case that no opposition shall have been expressed before or in the conference by any of the contracting States.

If the State should let three years go without paying its contribution, that contribution shall be divided among the other States proportionally to their own contribution. The additional sum thus paid by the States to make up the whole of the appropriation of the bureau shall be regarded as an advance to the delinquent State and shall be reimbursed to them if that State should make good its arrears. The advantages and prerogatives conferred by adhering to the meter convention are suspended in the case of States that have been delinquent three years.

After three more years the delinquent State shall be expelled from the convention and the reckoning of the contributions restored in accordance with the provisions of article 20 of these regulations.

*Art. 7.* The general conference mentioned in article 3 of this convention shall be at Paris, upon the summons of the international committee, at least once every six years.

It shall be its duty to discuss and initiate measures necessary for the dissemination and improvement of the metrical system, and to pass upon such new fundamental metrological determinations as may have been made during the time when it was not in session. It shall receive the report of the international committee concerning the work that has been accomplished, and shall replace one-half of the international committee by secret ballot.

The voting in the general conference shall be by States; each State shall be entitled to one vote.

Each of the members of the international committee shall be entitled to a seat at the meetings of the conference. They may at the same time be delegates of their Governments.

*Art. 8.* The international committee mentioned at article 3 of the convention shall be composed of 18 members all from different States.

At the time of the renewal by halves of the international committee the outgoing members shall be first those who may have been provisionally elected to fill vacancies between two sessions of the conference; the others will be drawn by lot. Outgoing members may be reelected.

*Art. 9.* The international committee organizes itself by electing by its own secret vote its chairman and secretary. Those appointments are notified to the Governments of the high contracting parties.

The chairman and the secretary of the committee and the director of the bureau must belong to different countries.

Once organized, the committee can not hold other elections or make other appointments until three months shall have elapsed after the notice of a vacancy calling for a vote shall have been given to all the members.

*Art. 10.* The international committee directs all the metrological works that the high contracting parties shall decide to have carried on jointly.

It is also charged with the duty of seeing to the conservation of the international prototypes and standards.

It may, lastly, institute the cooperation of specialists in questions of metrology and coordinate the results of their work.

*Art. 11.* The committee shall meet at least once in two years.

*Art. 12.* The balloting in the committee is by a majority vote; in case of a tie vote the chairman has the casting vote.

Decisions are only valid if the members present are at least one half of the elected members forming the committee.

Subject to that condition absent members have a right to delegate their votes to present members who must prove that they have been so delegated. This also applies to appointments by secret ballot.

The director of the bureau is a nonvoting member of the committee.

*Art. 13.* During the interval occurring between two sessions the committee shall have the right to discuss questions by correspondence.

In such cases, in order that its resolutions may be considered to have been adopted in due form, it shall be necessary for all the members of the committee to have been called upon to express their opinions.

*Art. 14.* The international committee for weights and measures shall provisionally fill such vacancies as may occur in it; these elections shall take place by correspondence, each of the members being called upon to take part therein.

*Art. 15.* The international committee will draw up a detailed set of regulations for the organization and work of the bureau and will fix the dues to be paid for the extraordinary works provided by articles 6 and 7 of the convention.

Those dues will be applied to improving the scientific equipment of the bureau. A certain amount may be drawn annually for the retirement fund from the total dues collected by the bureau.

*Art. 16.* All communications from the international committee to the Governments of the high contracting parties shall take place through the diplomatic representatives of such countries at Paris.

For all matters requiring the attention of the French authorities, the committees shall have recourse to the ministry of foreign affairs of France.

*Art. 17.* A regulation drawn up by the committee will determine the maximum staff for each category of the personnel of the bureau. The director and his assistants shall be elected by secret ballot by the international committee. Other appointments shall be notified to the Governments of the high contracting parties. The director will appoint the other members of the personnel within the bounds laid by the regulation mentioned in the first paragraph above.

*Art. 18.* The director of the bureau shall have access to the place where the international prototypes are deposited only in pursuance of a resolution of the committee and in the presence of at least one of its members. The place of deposit of the prototype shall be opened only by means of three keys, one of which shall be in the possession of the director of archives

of France, the second in that of the chairman of the committee, and the third in that of the director of the bureau.

The standards of the class of national prototypes alone shall be used for the ordinary comparing work of the bureau.

*Art. 19.* The director of the bureau shall annually furnish to the committee: First, a financial report concerning the accounts of the preceding year, which shall be examined, and if found correct, a certificate to that effect shall be given him; second, a report on the condition of the apparatus; third, a general report concerning the work accomplished during the course of the year just closed.

The international committee shall make to each of the Governments of the high contracting parties an annual report concerning all its scientific, technical, and administrative operations, and concerning those of the bureau. The chairman of the committee shall make a report to the general conference concerning the work that has been accomplished since its last session.

The reports and publications of the committee shall be in the French language. They shall be printed and furnished to the Governments of the high contracting parties.

*Art. 20.* The scale of contributions spoken of in article 9 of the convention is established for its fixed part on the basis of the appropriation referred to in article 6 of the present regulations and of the population: the normal contribution of each State can not be less than five to a thousand nor more than 15 per cent of the whole appropriation, regardless of the population. In order to establish that scale, it shall first be found which are the States that are in the conditions required for the minimum and maximum and the remainder of the quota shall be distributed among the other States in the direct ratio of their population.

The quota thus reckoned stands for the whole time included between two consecutive general conferences and can only be modified in the meanwhile in the following cases:

(a) If one of the adhering States allows three successive years to pass without making its payments;

(b) When, on the contrary, a State which had been previously delinquent for more than three years pays up its arrears, and the occasion arises to return to the other Governments the advances made by them.

The complementary contribution is computed on the same basis of population and is like that which the States that have long belonged to the convention pay under the same conditions.

If after adhering to the convention a State declares it would like to extend the benefits thereof to one or more of its colonies that are not autonomous, the number of the population of the said colonies would be added to that of the State in reckoning the scale of contributions.

When a colony that is recognized as autonomous shall desire to adhere to the convention, it will be regarded with respect to its admission into the convention and as the mother country may decide, either as a dependency of that mother country or as a contracting State.

*Art. 21.* The expense of constructing the international prototypes and the standards and test copies which are to accompany them shall be defrayed by the high contracting parties in accordance with the scale fixed in the foregoing article.

The amounts to be paid for the comparison and verification of standards required by States not represented at this convention shall be regulated by the committee in conformity with the rates fixed in virtue of article 15 of the regulations.

*Art. 22.* These regulations shall have the same force and value as the convention to which they are annexed. • • •

On January 2, 1890, "meter No. 27" and "kilogram No. 20", being copies of the international prototype meter and kilogram preserved at the International Bureau of Weights and Measures, were opened at the White House and accepted by President Harrison as national standards. Duplicates of these, being "meter No. 21" and "kilogram No. 4", were received later in the same year. These standards were

given into the custody of the Office of Standard Weights and Measures of the Coast and Geodetic Survey of the Treasury Department.

In 1893 a ruling of fundamental importance with respect to standards was made by T. C. Mendenhall, the Superintendent of Standard Weights and Measures. This ruling, which subsequently came to be known as the "Mendenhall Order", was approved April 5, 1893, by the Secretary of the Treasury; its essential part is as follows:

Bulletin No. 26, "Fundamental Standards of Length and Mass", United States Coast and Geodetic Survey, Treasury Department, April 5, 1893.

• • • the Office of Weights and Measures, with the approval of the Secretary of the Treasury, will in the future, regard the International Prototype Metre and Kilogramme as fundamental standards, and the customary units, the yard and the pound, will be derived therefrom in accordance with the Act of July 28, 1866. • • •

Bulletin No. 26 also carried a "Note", as follows:

**NOTE.**—Reference to the Act of 1866, results in the establishment of the following:

*Equations*

$$1 \text{ yard} = \frac{3600}{3937} \text{ metre.}$$

$$1 \text{ pound avoirdupois} = \frac{1}{2.2046} \text{ kilo.}$$

A more precise value of the English pound avoirdupois is

$$\frac{1}{2.20462} \text{ kilo.}$$

differing from the above by about one part in one hundred thousand, but the equation established by law is sufficiently accurate for all ordinary conversions.

As already stated, in work of high precision the kilogramme is now all but universally used and no conversion is required.

The National Bureau of Standards continues to consider the relation

$$1 \text{ yard} = \frac{3600}{3937} \text{ meter}$$

which may also be expressed

$$1 \text{ meter} = 39.37 \text{ inches}$$

as an exact equivalent. In the case of the relation between the avoirdupois pound and the kilogram, however, the National Bureau of Standards now recognizes as the fundamental relation

$$1 \text{ avoirdupois pound} = 0.453\,592\,427\,7 \text{ kilogram}$$

which corresponds with

$$1 \text{ kilogram} = 2.204\,622\,841 \text{ avoirdupois pounds.}$$

APPENDIX I

Legal Documents Concerning "Standard Time"

Contents:

Uniform Time Act of 1966 (15 U.S.C. 260 to 267);

Public Law 89-387;

Title 49, Code of Federal Regulations, Subtitle A, Part 71;

Map of U.S. Time Zones.



said sections shall be deemed guilty of a misdemeanor and be liable to a fine not exceeding \$100. (Aug. 23, 1916, ch. 396, § 5, 39 Stat. 531.)

**SECTION REFERRED TO IN OTHER SECTIONS**

This section is referred to in sections 240, 242 of this title.

**§ 242. Duty of United States attorney to enforce law.**

It shall be the duty of each United States attorney, to whom satisfactory evidence of any violation of sections 237 to 242 of this title is presented, to cause appropriate proceedings to be commenced and prosecuted in the United States court having jurisdiction of such offense. (Aug. 23, 1916, ch. 396, § 6, 39 Stat. 531; June 25, 1948, ch. 646, § 1, 62 Stat. 909.)

**CHANGE OF NAME**

Act June 25, 1948, eff. Sept. 1, 1948, substituted "United States attorney" for "district attorney". See section 501 of Title 28, Judiciary and Judicial Procedure.

**SECTION REFERRED TO IN OTHER SECTIONS**

This section is referred to in sections 240, 241 of this title.

**STANDARD BASKETS AND CONTAINERS**

§§ 251 to 256. Repealed. Pub. L. 90-628, § 1(a), Oct. 22, 1968, 82 Stat. 1320.

Section 251, acts Aug. 31, 1916, ch. 426, § 1, 39 Stat. 673; June 11, 1934, ch. 447, § 1, 48 Stat. 930, set the standards for Climax baskets for grapes and other fruits and vegetables and for mushrooms.

Section 252, act Aug. 31, 1916, ch. 426, § 2, 39 Stat. 673, set the standards for the standard basket or container for small fruits and vegetables.

Section 253, act Aug. 31, 1916, ch. 426, § 3, 39 Stat. 674, June 11, 1934, c. 447, § 2, 48 Stat. 930, set the penalties for failure to conform to standards.

Section 254, act Aug. 31, 1916, ch. 426, § 4, 39 Stat. 674, provided for examinations and tests by the Department of Agriculture and for the promulgation of rules and regulations covering allowable tolerances and variations.

Section 255, acts Aug. 31, 1916, ch. 426, § 5, 39 Stat. 674; June 25, 1948, ch. 646, § 1, 62 Stat. 909, made the United States attorney responsible for commencing actions to enforce penalties.

Section 256, act Aug. 31, 1916, ch. 426, § 6, 39 Stat. 674, covered the guaranty given by manufacturers or sellers of baskets as to the correctness of such containers.

**EFFECTIVE DATE OF REPEAL**

Section 3 of Pub. L. 90-628 provided that: "This Act [repealing sections 251-257 of this title and amending section 1459(b)(3) of this title] shall become effective 60 days after enactment [Oct. 22, 1968]."

**STANDARD HAMPERS, ROUND STAVE BASKETS, AND SPLINT BASKETS FOR FRUITS AND VEGETABLES**

§§ 257 to 257i. Repealed. Pub. L. 90-628, § 1(b), Oct. 22, 1968, 82 Stat. 1320.

Section 257, acts May 21, 1928, ch. 664, § 1, 45 Stat. 685; June 28, 1954, ch. 406, § 1, 68 Stat. 301; Aug. 30, 1964, Pub. L. 88-516, § 1, 78 Stat. 697, set the dimensions for standard hampers and round stave baskets.

Section 257a, acts May 21, 1928, ch. 664, § 2, 45 Stat. 685; Aug. 30, 1964, Pub. L. 88-516, § 2, 78 Stat. 697, set the dimensions for standard splint baskets.

Section 257b, act May 21, 1928, ch. 664, § 3, 45 Stat. 686, provided for the promulgation of regulations allowing reasonable variations in hampers and baskets.

Section 257c, act May 21, 1928, ch. 664, § 4, 45 Stat. 686, required approval by the Secretary of Agriculture of the manufacturer's dimension specifications for hampers and baskets.

Section 257d, acts May 21, 1928, ch. 664, § 5, 45 Stat. 686; Aug. 30, 1964, Pub. L. 88-516, § 3, 78 Stat. 697, set out penalties for violations and covered the guaranty given by manufacturers and sellers of hampers and baskets as to their correctness.

Section 257e, act May 21, 1928, ch. 664, § 6, 45 Stat. 686, provided for the seizure of illegal hampers and baskets, and the procedure covering their condemnation.

Section 257f, act May 21, 1928, ch. 664, § 7, 45 Stat. 687, allowed manufacture of hampers and baskets for foreign sale in conformity with foreign specifications.

Section 257g, acts May 21, 1928, ch. 664, § 8, 45 Stat. 687, June 25, 1948, ch. 646, § 1, 62 Stat. 909, placed upon the United States Attorney the duty to prosecute for violations of sections 257-257i of this title.

Section 257h, act May 21, 1928, ch. 664, § 9, 45 Stat. 687, provided for the promulgation of regulations covering examinations and tests by the Secretary of Agriculture.

Section 257i, act May 21, 1968, ch. 664, § 10, 45 Stat. 687, authorized the Secretary of Agriculture to cooperate with other agencies in carrying out sections 257-257i of this title.

**EFFECTIVE DATE OF REPEAL**

Repeal of sections 257-257i of this title effective 60 days after Oct. 22, 1968, see section 3 of Pub. L. 90-628, set out as a note under section 251 of this title.

**STANDARD TIME**

§ 260. Congressional declaration of policy; adoption and observance of uniform standard of time; authority of Secretary of Transportation.

It is the policy of the United States to promote the adoption and observance of uniform time within the standard time zones prescribed by sections 261 to 264 of this title, as modified by section 265 of this title. To this end the Secretary of Transportation is authorized and directed to foster and promote widespread and uniform adoption and observance of the same standard of time within and throughout each such standard time zone. (Pub. L. 89-387, § 2, Apr. 13, 1966, 80 Stat. 107.)

**EFFECTIVE DATE**

Section 6 of Pub. L. 89-387 provided that: "This Act [which enacted sections 260, 260a, 266, and 267 of this title and amended sections 261-263 of this title] shall take effect on April 1, 1967; except that if any State, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States, or any political subdivision thereof, observes daylight saving time in the year 1966, such time shall advance the standard time otherwise applicable in such place by one hour and shall commence at 2 o'clock antemeridian on the last Sunday in April of the year 1966 and shall end at 2 o'clock antemeridian on the last Sunday in October of the year 1966."

**SHORT TITLE**

Section 1 of Pub. L. 89-387 provided: "That this Act [which enacted sections 260, 260a, 266, and 267 of this title, and amended sections 261-263 of this title, and enacted provisions set out as notes under this section] may be cited as the 'Uniform Time Act of 1966'."

**TRANSFER OF FUNCTIONS**

Reference to the Interstate Commerce Commission was changed to the Secretary of Transportation pursuant to Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation and vested all powers, duties and functions of the Interstate Commerce Commission and of the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section in the Secretary of Transportation. See section 1655(e)(5) of Title 49, Transportation.

**SECTION REFERRED TO IN OTHER SECTIONS**

This section is referred to in sections 266, 267 of this title.

**§ 260a. Advancement of time or changeover dates.**

**(a) Duration of period; State exemption.**

During the period commencing at 2 o'clock antemeridian on the last Sunday of April of each year and ending at 2 o'clock antemeridian on the last Sunday of October of each year, the standard time of each zone established by sections 261 to 264 of this title, as modified by section 265 of this title, shall be advanced one hour and such time as so advanced shall for the purposes of such sections 261 to 264, as so modified, be the standard time of such zone during such period; except that any State may by law exempt itself from the provisions of this subsection providing for the advancement of time, but only if such law provides that the entire State (including all political subdivisions thereof) shall observe the standard time otherwise applicable under such sections 261 to 264, as so modified during such period.

**(b) State laws superseded.**

It is hereby declared that it is the express intent of Congress by this section to supersede any and all laws of the States or political subdivisions thereof insofar as they may now or hereafter provide for advances in time or changeover dates different from those specified in this section.

**(c) Violations; enforcement.**

For any violation of the provisions of this section the Secretary of Transportation or his duly authorized agent may apply to the district court of the United States for the district in which such violation occurs for the enforcement of this section; and such court shall have jurisdiction to enforce obedience thereto by writ of injunction or by other process, mandatory or otherwise, restraining against further violations of this section and enjoining obedience thereto. (Pub. L. 89-387, § 3, Apr. 13, 1966, 80 Stat. 107.)

**TRANSFER OF FUNCTIONS**

Reference to the Interstate Commerce Commission was changed to the Secretary of Transportation pursuant to Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation and vested all powers, duties and functions of the Interstate Commerce Commission and of the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section in the Secretary of Transportation. See section 1655(e)(5) of Title 49, Transportation.

**SECTION REFERRED TO IN OTHER SECTIONS**

This section is referred to in section 261 of this title.

**§ 261. Zones for standard time; interstate or foreign commerce.**

For the purpose of establishing the standard time of the United States, the territory of the United States shall be divided into eight zones in the manner provided in this section. Except as provided in section 260a(a) of this title, the standard time of the first zone shall be based on the mean solar time of the sixtieth degree of longitude west from Greenwich; that of the second zone on the seventy-fifth degree; that of the third zone on the ninetieth degree; that of the fourth zone on the one hundred and fifth degree; that of the fifth zone on the one hundred and twentieth degree; that of the sixth zone on the one hundred and thirty-fifth degree; that of

the seventh zone on the one hundred and fiftieth degree; and that of the eighth zone on the one hundred and sixty-fifth degree. The limits of each zone shall be defined by an order of the Secretary of Transportation, having regard for the convenience of commerce and the existing junction points and division points of common carriers engaged in interstate or foreign commerce, and any such order may be modified from time to time. As used in sections 261-264 of this title, the term "interstate or foreign commerce" means commerce between a State, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States and any place outside thereof. (Mar. 19, 1918, ch. 24, § 1, 40 Stat. 450; Apr. 13, 1966, Pub. L. 89-387, § 4(a), 80 Stat. 108.)

**AMENDMENTS**

1966 - Pub. L. 89-387 increased the number of time zones from five for the territory of continental United States to eight for the territory of the United States, inserted the "exception phrase", substituted "solar" for "astronomical" time, established the first zone on basis of the 60th degree of longitude west from Greenwich, redesignated as the second through the fifth zones based on the 75th, 90th, 105th, and 120th degrees former zones one through four based on such degrees, established the sixth zone based on the 135th degree, redesignated as the seventh zone based on the 150th degree former fifth zone based on such degree, and established the eighth zone based on the 165th degree, substituted "interstate or foreign commerce" for "commerce between the several States and and with foreign nations" and defined "interstate or foreign commerce."

**REPEALS**

Section 5 of act Mar. 19, 1918, repealed all conflicting acts and parts of acts.

**DISTRICT OF COLUMBIA**

Act March 31, 1949, ch. 43, 63 Stat. 29, authorized the Board of Commissioners [now the District of Columbia Council] to establish daylight-saving time in the District of Columbia.

**RETURN TO STANDARD TIME**

Act Sept. 25, 1945, ch. 388, 59 Stat. 537, provided, that, notwithstanding the provisions of act Jan. 20, 1942, ch. 7, 56 Stat. 9, which provided for war time, the standard time for each zone as provided for in sections 261-264 of this title should again become effective as of Sept. 30, 1945, at 2:00 A. M.

**TRANSFER OF FUNCTIONS**

Reference to the Interstate Commerce Commission was changed to the Secretary of Transportation pursuant to Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation and vested all powers, duties and functions of the Interstate Commerce Commission and of the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section in the Secretary of Transportation. See section 1655(a)(5) of Title 49, Transportation.

**SECTION REFERRED TO IN OTHER SECTIONS**

This section is referred to in sections 260, 260a, 262, 266, 267 of this title.

**§ 262. Duty to observe standard time of zones.**

Within the respective zones created under the authority of sections 261 to 264 of this title the standard time of the zone shall insofar as practicable (as determined by the Secretary of Transportation) govern the movement of all common carriers engaged in interstate or foreign commerce. In all statutes, orders, rules, and regulations relating to the time of performance of any act by any officer or department of the United States, whether in the

legislative, executive, or judicial branches of the Government, or relating to the time within which any rights shall accrue or determine, or within which any act shall or shall not be performed by any person subject to the jurisdiction of the United States, it shall be understood and intended that the time shall insofar as practicable (as determined by the Secretary of Transportation) be the United States standard time of the zone within which the act is to be performed. (Mar. 19, 1918, ch. 24, § 2, 40 Stat. 451; Apr. 13, 1966, Pub. L. 89-387, § 4(b), 80 Stat. 108.)

AMENDMENTS

1966—Pub. L. 89-387 inserted "insofar as practicable (as determined by the Interstate Commerce Commission)" in two instances and substituted "engaged in interstate or foreign commerce" for "engaged in commerce between the several States or between a State and any one of the Territories of the United States, or between a State or the Territory of Alaska and any one of the insular possessions of the United States or any foreign country".

TRANSFER OF FUNCTIONS

Reference to the Interstate Commerce Commission was changed to the Secretary of Transportation pursuant to Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation and vested all powers, duties and functions of the Interstate Commerce Commission and of the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section in the Secretary of Transportation. See section 1655(e)(5) of Title 49, Transportation.

SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in sections 260, 260a, 261, 266, 267 of this title.

§ 263. Designation of zone standard times.

The standard time of the first zone shall be known and designated as Atlantic standard time; that of the second zone shall be known and designated as eastern standard time; that of the third zone shall be known and designated as central standard time; that of the fourth zone shall be known and designated as mountain standard time; that of the fifth zone shall be known and designated as Pacific standard time; that of the sixth zone shall be known and designated as Yukon standard time; that of the seventh zone shall be known and designated as Alaska-Hawaii standard time; and that of the eighth zone shall be known and designated as Bering standard time. (Mar. 19, 1918, ch. 24, § 4, 40 Stat. 451; Apr. 13, 1966, Pub. L. 89-387, § 4(c), 80 Stat. 108.)

AMENDMENTS

1966—Pub. L. 89-387 added Atlantic standard time as first zone designation; redesignated as eastern standard time, central standard time, mountain standard time and Pacific standard time for second through fifth zones former designation of United States standard eastern time, United States standard central time, United States standard mountain time and United States standard Pacific time for former zones one through four; added Yukon standard time as sixth zone designation; redesignated as Alaska-Hawaii standard time for seventh zone former designation of United States standard Alaska time for fifth zone; and added Bering standard time as eighth zone designation.

TRANSFER OF FUNCTIONS

All functions, powers, and duties of this Interstate Commerce Commission and the Chairman, members, offices, and officers thereof relating generally to standard

time zones and daylight savings time under this section were transferred to and vested in the Secretary of Transportation by Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation. See section 1655(e)(5) of Title 49, Transportation.

SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in sections 260, 260a, 261, 262, 266, 267 of this title.

§ 264. Part of Idaho in third zone.

In the division of territory, and in the definition of the limits of each zone, as provided in sections 261 to 264 of this title, so much of the State of Idaho as lies south of the Salmon River, traversing the State from east to west near forty-five degree thirty minutes latitude, shall be embraced in the third zone: *Provided*, That common carriers within such portion of the State of Idaho may conduct their operations on Pacific time. (Mar. 19, 1918, ch. 24, § 3, as added Mar. 3, 1923, ch. 216, 42 Stat. 1434, and amended June 24, 1948, ch. 631, § 1, 62 Stat. 646.)

AMENDMENTS

1948—Act June 24, 1948, added proviso relating to common carriers.

EFFECTIVE DATE OF 1948 AMENDMENT

Section 2 of act June 24, 1948, provided that: "This Act [act June 24, 1948] shall take effect at 2 o'clock antemeridian of the second Monday following the date of its enactment [June 24, 1948]."

REPEALS

The original section 3 of act Mar. 19, 1918, providing for daylight-savings, was repealed by act Aug. 20, 1919, ch. 61, 41 Stat. 280.

TRANSFER OF FUNCTIONS

All functions, powers, and duties of the Interstate Commerce Commission and the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section were transferred to and vested in the Secretary of Transportation by Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation. See section 1655(e)(5) of Title 49, Transportation.

SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in sections 260, 260a, 261, 262, 266 of this title.

§ 265. Transfer of certain territory to standard central-time zone.

The Panhandle and Plains sections of Texas and Oklahoma are transferred to and placed within the United States standard central-time zone.

The Secretary of Transportation is authorized and directed to issue an order placing the western boundary line of the United States standard central-time zone insofar as the same affect Texas and Oklahoma as follows:

Beginning at a point where such western boundary time zone line crosses the State boundary line between Kansas and Oklahoma; thence westerly along said State boundary line to the northwest corner of the State of Oklahoma; thence in a southerly direction along the west State boundary line of Oklahoma and the west State boundary line of Texas to the southeastern corner of the State of New Mexico; thence in a westerly direction along the State boundary line between the States of Texas and New Mexico to the Rio Grande River; thence down the Rio Grande River as the boundary line between the United States and Mexico: *Provided*,

That the Chicago, Rock Island and Gulf Railway Company and the Chicago, Rock Island and Pacific Railway Company may use Tucumcari, New Mexico, as the point at which they change from central to mountain time and vice versa; the Colorado Southern and Fort Worth and Denver City Railway Companies may use Sixela, New Mexico, as such changing point; the Atchison, Topcka and Santa Fe Railway Company and other branches of the Santa Fe system may use Clovis, New Mexico, as such changing point, and those railways running into or through El Paso may use El Paso as such point: *Provided further*, That this section shall not, except as herein provided, interfere with the adjustment of time zones as established by the Secretary of Transportation. (Mar. 4, 1921, ch. 173, § 1, 41 Stat. 1446.)

#### REPEALS

Section 2 of act Mar. 4, 1921, repealed all conflicting laws and parts of laws.

#### TRANSFER OF FUNCTIONS

Reference to the Interstate Commerce Commission was changed to the Secretary of Transportation pursuant to Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation and vested all powers, duties and functions of the Interstate Commerce Commission and of the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section in the Secretary of Transportation. See section 1655(e) (5) of Title 49, Transportation.

#### TRANSFER OF EL PASO AND HUDSPETH COUNTIES, TEXAS, TO MOUNTAIN STANDARD TIME ZONE

Pub. L. 91-228, Apr. 10, 1970, 84 Stat. 119, provided: "That, notwithstanding the first section of the Act of March 4, 1921 (15 U.S.C. 265) [this section], the Secretary of Transportation may, upon the written request of the County Commissioners Court of El Paso County, Texas, change the boundary line between the central standard time zone and the mountain standard time zone, so as to place El Paso County in the mountain standard time zone, in the manner prescribed in section 1 of the Act of March 19, 1918, as amended (15 U.S.C. 261), and section 5 of the Act of April 13, 1906 (15 U.S.C. 266). In the same manner, the Secretary of Transportation may also place Hudspeth County, Texas, in the mountain standard time zone, if the Hudspeth County Commissioners Court so requests in writing and if El Paso County is to be placed in that time zone."

#### SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in sections 260, 260a, 266 of this title.

#### § 266. Applicability of Administrative Procedure Act.

The Administrative Procedure Act shall apply to all proceedings under sections 260 to 267 of this title. (Pub. L. 89-387, § 5, Apr. 13, 1966, 80 Stat. 108.)

#### REFERENCES IN TEXT

The Administrative Procedure Act, referred to in text, is classified to sections 551 et seq. and 701 et seq. of Title 5, Government Organization and Employees.

#### CODIFICATION

"Sections 260 to 267 of this title" read in the original "this Act [meaning Pub. L. 89-387], the Act of March 19, 1918 (15 U.S.C. 261-264), and the Act of March 4, 1921 (15 U.S.C. 265)", which are classified to sections 260-263, 266, 267; 261-264; and 265 of this title, respectively.

#### TRANSFER OF FUNCTIONS

All functions, powers, and duties of the Interstate Commerce Commission and the Chairman, members, offices, and officers thereof relating generally to standards time zones and daylight savings time under this section

were transferred to and vested in the Secretary of Transportation by Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation. See section 1655(e) (5) of Title 49, Transportation.

#### SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in section 267 of this title.

#### § 267. State defined.

As used in sections 260 to 263, 266 and 267 of this title, the term "State" includes the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States. (Pub. L. 89-387, § 7, Apr. 13, 1966, 80 Stat. 109.)

#### TRANSFER OF FUNCTIONS

All functions, powers, and duties of the Interstate Commerce Commission and the Chairman, members, offices, and officers thereof relating generally to standard time zones and daylight savings time under this section were transferred to and vested in the Secretary of Transportation by Pub. L. 89-670, Oct. 15, 1966, 80 Stat. 931, which created the Department of Transportation. See section 1655(e) (5) of Title 49, Transportation.

#### SECTION REFERRED TO IN OTHER SECTIONS

This section is referred to in section 266 of this title.

### Chapter 7.—THE BUREAU OF STANDARDS

#### Sec.

- 271. Bureau established.
- 272. Functions of Secretary.
- 273. Functions; for whom exercised.
- 274. Director; powers and duties; report.
- 275. Appointment of officers and employees.
- 275a. Service charges.
- 276. Ownership of facilities.
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- 278. Visiting committee.
- 278a. Repealed.
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  - (a) Utilization; appropriations.
  - (b) Availability of Fund.
  - (c) Reimbursements.
  - (d) Credits.
  - (e) Cost defined.
  - (f) Distribution of earnings; restoration of prior impairment.
- 278c. Acquisition of land for field sites.
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- 278f. Fire research and safety program; functions of Secretary of Commerce.
  - (a) Investigations for determination of pertinent factors; prevention, control, and reduction of effects, methods and techniques; educational programs; fire information reference services; demonstration projects.
  - (b) Engineering or science curriculums; instructional materials and aids.
- 278g. Same; general provisions.
  - (a) Eligibility for grants; amount; conditions; definitions.
  - (b) Reimbursement of Federal agencies; delegation of powers.
  - (c) Advances of public moneys.
  - (d) Cooperation of Federal agencies.
  - (e) Administration of functions; rules and regulations.
- 279. Absence of Director.
- 280. Apprentices; promotion.
- 281. Testing materials for District of Columbia.
- 282. National hydraulic laboratory; establishment; purpose; study of Federal and State projects.
- 283. Repealed.
- 284. Transfer of materials, supplies, and equipment to Bureau for Arctic ionosphere observation by Departments of Army, Navy, and Air Force.
- 285, 286. Repealed.



Public Law 89-387  
89th Congress, S. 1404  
April 13, 1966

**An Act**

To promote the observance of a uniform system of time throughout the United States.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Uniform Time Act of 1966".*

Uniform Time  
Act of 1966.

**Sec. 2.** It is the policy of the United States to promote the adoption and observance of uniform time within the standard time zones prescribed by the Act entitled "An Act to save daylight and to provide standard time for the United States", approved March 19, 1918 (40 Stat. 450; 15 U.S.C. 261-264), as modified by the Act entitled "An Act to transfer the Panhandle and Plains section of Texas and Oklahoma to the United States standard central time zone", approved March 4, 1921 (41 Stat. 1446; 15 U.S.C. 265). To this end the Interstate Commerce Commission is authorized and directed to foster and promote widespread and uniform adoption and observance of the same standard of time within and throughout each such standard time zone.

**Sec. 3. (a)** During the period commencing at 2 o'clock antemeridian on the last Sunday of April of each year and ending at 2 o'clock antemeridian on the last Sunday of October of each year, the standard time of each zone established by the Act of March 19, 1918 (15 U.S.C. 261-264), as modified by the Act of March 4, 1921 (15 U.S.C. 265), shall be advanced one hour and such time as so advanced shall for the purposes of such Act of March 19, 1918, as so modified, be the standard time of such zone during such period; except that any State may by law exempt itself from the provisions of this subsection providing for the advancement of time, but only if such law provides that the entire State (including all political subdivisions thereof) shall observe the standard time otherwise applicable under such Act of March 19, 1918, as so modified, during such period.

**(b)** It is hereby declared that it is the express intent of Congress by this section to supersede any and all laws of the States or political subdivisions thereof insofar as they may now or hereafter provide for advances in time or changeover dates different from those specified in this section.

**(c)** For any violation of the provisions of this section the Interstate Commerce Commission or its duly authorized agent may apply to the district court of the United States for the district in which such violation occurs for the enforcement of this section; and such court shall have jurisdiction to enforce obedience thereto by writ of injunction or by other process, mandatory or otherwise, restraining against further violations of this section and enjoining obedience thereto.

Violations.

80 STAT. 107.  
80 STAT. 108.

**Sec. 4. (a)** The first section of the Act of March 19, 1918, as amended (15 U.S.C. 261), is amended to read as follows:

Standard time  
zones.

"That for the purpose of establishing the standard time of the United States, the territory of the United States shall be divided into eight zones in the manner provided in this section. Except as provided in section 3(a) of the Uniform Time Act of 1966, the standard time of the first zone shall be based on the mean solar time of the

sixtieth degree of longitude west from Greenwich; that of the second zone on the seventy-fifth degree; that of the third zone on the ninetieth degree; that of the fourth zone on the one hundred and fifth degree; that of the fifth zone on the one hundred and twentieth degree; that of the sixth zone on the one hundred and thirty-fifth degree; that of the seventh zone on the one hundred and fiftieth degree; and that of the eighth zone on the one hundred and sixty-fifth degree. The limits of each zone shall be defined by an order of the Interstate Commerce Commission, having regard for the convenience of commerce and the existing junction points and division points of common carriers engaged in interstate or foreign commerce, and any such order may be modified from time to time. As used in this Act, the term 'interstate or foreign commerce' means commerce between a State, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States and any place outside thereof."

"Interstate or foreign commerce."

15 USC 262.

(b) Section 2 of such Act is amended to read as follows:

"Sec. 2. Within the respective zones created under the authority of this Act the standard time of the zone shall insofar as practicable (as determined by the Interstate Commerce Commission) govern the movement of all common carriers engaged in interstate or foreign commerce. In all statutes, orders, rules, and regulations relating to the time of performance of any act by any officer or department of the United States, whether in the legislative, executive, or judicial branches of the Government, or relating to the time within which any rights shall accrue or determine, or within which any act shall or shall not be performed by any person subject to the jurisdiction of the United States, it shall be understood and intended that the time shall insofar as practicable (as determined by the Interstate Commerce Commission) be the United States standard time of the zone within which the act is to be performed."

Designations.

(c) Section 4 of such Act is amended to read as follows:

"Sec. 4. The standard time of the first zone shall be known and designated as Atlantic standard time; that of the second zone shall be known and designated as eastern standard time; that of the third zone shall be known and designated as central standard time; that of the fourth zone shall be known and designated as mountain standard time; that of the fifth zone shall be known and designated as Pacific standard time; that of the sixth zone shall be known and designated as Yukon standard time; that of the seventh zone shall be known and designated as Alaska-Hawaii standard time; and that of the eighth zone shall be known and designated as Bering standard time."

60 Stat. 237.

Sec. 5. The Administrative Procedure Act (5 U.S.C. 1001-1011) shall apply to all proceedings under this Act, the Act of March 19, 1918 (15 U.S.C. 261-264), and the Act of March 4, 1921 (15 U.S.C. 265).

Effective date.

Sec. 6. This Act shall take effect on April 1, 1967; except that if any State, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States, or any political subdivision thereof, observes daylight saving time in the year 1966, such time shall advance the standard time otherwise applicable in such place by one hour and shall commence at 2 o'clock antemeridian on the last

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- 3 -

Pub. Law 89-387

80 STAT. 109

Sunday in April of the year 1966 and shall end at 2 o'clock ante-meridian on the last Sunday in October of the year 1966.

Sec. 7. As used in this Act, the term "State" includes the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States.

Approved April 13, 1966.

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LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 1315 accompanying H. R. 6785 (Comm. on Interstate & Foreign Commerce) and No. 1385 (Comm. of Conference).

SENATE REPORT No. 268 (Comm. on Commerce).

CONGRESSIONAL RECORD:

Vol. 111 (1965): June 3, considered and passed Senate.

Vol. 112 (1966): Mar. 16, considered and passed House, amended, in lieu of H. R. 6785.

Mar. 22, Senate concurred in House amendment with amendments.

Mar. 29, Senate agreed to conference report.

Mar. 30, House agreed to conference report.

**Title 49—TRANSPORTATION**  
**Subtitle A—Office of the Secretary of Transportation**

[OST Docket No. 27; Amdt. 71-11]

**PART 71—STANDARD TIME ZONE BOUNDARIES**

The purpose of this amendment is to recodify Part 71 of Title 49 of the Code of Federal Regulations—Standard Time Zone Boundaries.

Because of the cumulative effect of past time zone boundary relocations, each published as a separate amendment by the Department of Transportation or its predecessor in this function, the Interstate Commerce Commission, Part 71 is recodified and republished as set forth below. This recodification contains several editorial corrections and some additional explanatory language, but no substantive changes have been made.

Since this is a recodification and does not involve any substantive change, notice and public procedure thereon are not required and the revised part may be made effective in less than 30 days.

In consideration of the foregoing, this recodification of Part 71 of Title 49 of the Code of Federal Regulations is effective on July 31, 1970.

Issued in Washington, D.C., on July 24, 1970.

**JOHN A. VOLPE,**  
*Secretary of Transportation.*

- Sec.  
71.1 Limits defined; exceptions authorized for certain rail operating purposes only.  
71.2 Annual advancement of standard time.  
71.3 Atlantic zone.  
71.4 Eastern zone.  
71.5 Boundary line between eastern and central zones.  
71.6 Central zone.  
71.7 Boundary line between central and mountain zones.  
71.8 Mountain zone.  
71.9 Boundary line between mountain and Pacific zones.  
71.10 Pacific zone.  
71.11 Yukon zone.  
71.12 Alaska-Hawaii zone.  
71.13 Bering zone.

**AUTHORITY:** The provisions of this Part 71 issued under secs. 1-4, 40 Stat. 450, as amended, sec. 1, 41 Stat. 1446, as amended, secs. 2-7, 80 Stat. 107-109, sec. 6(e) (5), 80 Stat. 937, sec. 1, 84 Stat. 119; 15 U.S.C. 260-267, 49 U.S.C. 1655(e) (5).

§ 71.1 Limits defined; exceptions authorized for certain rail operating purposes only.

(a) This part prescribes the geographic limits of each of the eight standard time zones established by section 1 of the Standard Time Act, as amended by section 4 of the Uniform Time Act of 1966 (15 U.S.C. 261). It also contains lists of operating exceptions granted for specified rail carriers, whose operations cross the time zone boundaries prescribed by this part, authorizing them to carry the standard of time on which the major portion of a particular operation is conducted into an adjoining time zone.

(b) Any rail carrier whose operations cross a time zone boundary prescribed by this part may apply for an operating exception to the General Counsel, Department of Transportation, Washington, D.C. 20590. However, each rail carrier for which an operating exception is granted shall, in its advertisements, time cards, station bulletin boards, and other publications, show arrival and departure times in terms of the standard time for the place concerned.

(c) The time zones established by the Standard Time Act, as amended by the Uniform Time Act of 1966, are Atlantic, eastern, central, mountain, Pacific, Yukon, Alaska-Hawaii, and Bering.

§ 71.2 Annual advancement of standard time.

(a) Section 3(a) of the Uniform Time Act of 1966 (15 U.S.C. 260a(a)) requires that "the standard time of each zone . . . shall be advanced 1 hour [during the period beginning at 2:00 a.m. on the last Sunday in April of each year and ending at 2:00 a.m. on the last Sunday in October] . . . and such time as so advanced shall be the standard time of such zone during such period." The section further authorizes any State to exempt itself from this requirement. For these reasons, all times (including the period of advanced time) in the United States, whether in an exempted State or not, shall be cited as "standard time" during the entire year.

(b) Section 3(b) of the Uniform Time Act of 1966 (15 U.S.C. 260a(b)) provides that "it is the express intent of Congress . . . to supersede any and all laws of the States or political subdivisions thereof insofar as they may now or hereafter provide for advances in time or changeover dates different from those specified in [section 3(a) of that Act]", which are those specified in paragraph (a) of this section.

35 F.R. 12317  
August 1, 1970



§ 71.3 Atlantic zone.

The first zone, the Atlantic standard time zone, includes that part of the United States that is between 52°30' W. longitude and 67°30' W. longitude and that part of the Commonwealth of Puerto Rico that is west of 67°30' W. longitude, but does not include any part of the State of Maine.

§ 71.4 Eastern zone.

The second zone, the eastern standard time zone, includes that part of the United States that is west of 67°30' W. longitude and east of the boundary line described in § 71.5, and includes all of the State of Maine, but does not include any part of the Commonwealth of Puerto Rico.

§ 71.5 Boundary line between eastern and central zones.

(a) *Minnesota - Michigan - Wisconsin.* From the junction of the western boundary of the State of Michigan with the boundary between the United States and Canada southerly and easterly along the western boundary of the State of Michigan to a point in the middle of Lake Michigan opposite the main channel of Green Bay; thence southerly along the western boundary of the State of Michigan to its junction with the southern boundary thereof and the northern boundary of the State of Indiana.

(b) *Indiana-Illinois.* From the junction of the western boundary of the State of Michigan with the northern boundary of the State of Indiana easterly along the northern boundary of the State of Indiana to the east line of La Porte County; thence southerly along the east line of La Porte County to the north line of Starke County; thence east along the north line of Starke County to the east line of Starke County; thence south along the east line of Starke County to the south line of Starke County; thence west along the south line of Starke County to the east line of Jasper County; thence south along the east line of Jasper County to the south line of Jasper County; thence west along the south lines of Jasper and Newton Counties to the western boundary of the State of Indiana; thence south along the western boundary of Indiana to the north line of Gibson County; thence east along the north lines of Gibson and Pike Counties to the east line of Pike County; thence south along the east lines of Pike and Warrick Counties to the north line of Warrick County; thence east along the north lines of Warrick and Spencer Counties to the east line of Spencer County; thence south along the east line of Spencer County to the Indiana-Kentucky boundary.

(c) *Kentucky.* From the junction of the east line of Spencer County, Ind., with the Indiana-Kentucky boundary easterly along that boundary to the west line of Meade County, Ky.; thence southeasterly and southwesterly along the west lines of Meade and Hardin Counties to the southwest corner of Hardin County; thence along the south lines of Hardin and Larue Counties to the northwest corner of Taylor County; thence southeasterly along the west (southwest) line of Taylor County and northeasterly along the east (southeast) line of Taylor County to the west line of Casey County; and thence southerly along the west and south lines of Casey, Pulaski, and McCreary Counties to the Kentucky-Tennessee boundary.

(d) *Tennessee.* From the junction of the west line of McCreary County, Ky., with the Kentucky-Tennessee boundary westerly along that boundary to the west line of Scott County, Tenn.; thence southerly along the west line of Scott County, the north and west lines of Morgan County, and the north line of Roane County to the north line of Rhea County; thence northwesterly along the north line of Rhea County; and thence southwesterly along the west lines of Rhea and Hamilton Counties to the Tennessee-Georgia boundary.

(e) *Georgia-Alabama.* From the junction of the west line of Hamilton County, Tenn., with the Tennessee-Georgia boundary westerly along that boundary to its junction with the Alabama-Georgia boundary; thence southerly along that boundary and the Florida-Georgia boundary to the southwest corner of the State of Georgia.

(f) *Florida.* From the southwest corner of the State of Georgia to the midpoint of the Apalachicola River on the downstream side of Jim Woodruff Dam; thence southerly along the middle of the main channel of the Apalachicola River and Apalachicola Bay to the Gulf of Mexico.

(g) *Operating exceptions—*(1) *Lines east of boundary excepted from eastern zone.* Those parts of the following lines of railroad located east of the zone boundary described in this section, are, for operating purposes only, excepted from the eastern standard time zone and included within the central standard time zone:

Railroad	From—	To—
Baltimore & Ohio.	East line of La Porte County, Ind. (west of Walkerton, Ind.).	West yard limits of Garrett, Ind.
Do.....	Illinois-Indiana State line (west of Dana, Ind.).	West yard limits of Indianapolis, Ind.
Do.....	Illinois-Indiana State line (west of Vincennes, Ind.).	Washington, Ind.
Chicago, Milwaukee, St. Paul & Pacific.	Illinois-Indiana State line (northwest of Dana, Ind.).	Seymour, Ind.
Do.....	Michigan-Wisconsin State line (south of Iron Mountain, Mich.).	Champlon, Ontonagon, and Iron River, Mich. <sup>1</sup>
Chicago & Northwestern.	Michigan-Wisconsin State line.	East lines of Marquette and Delta Counties, Mich. <sup>1</sup> Marlon, Ohio.
Erie-Lackawanna.	South line of Starke County, Ind. (near Ora, Ind.).	
Grand Trunk Western.	East line of La Porte County, Ind. (east of Mill Creek).	Michigan-Indiana State line (near Granger, Ind.).
Do.....	Michigan-Indiana State line (near Granger, Ind.).	Battle Creek, Mich. <sup>1</sup>
Illinois Central.	Illinois-Indiana State line (west of Riverton, Ind.).	South yard limits of Indianapolis, Ind.
Do.....	West line of Hardin County, Ky. (west of Summit, Ky.).	Hodgenville, Ky., and south yard limits of Louisville, Ky.
Louisville & Nashville.	West line of Meade County, Ky. (west of Gunston, Ky.).	Strawberry, Ky.
Do.....	South line of Hardin County, Ky. (south of Dombey, Ky.).	Lebanon Junction, Ky.
Do.....	West line of Hamilton County, Tenn. (west of Hooker, Ga.).	Western limits of Chattanooga, Tenn.
Do.....	Apalachicola River.	River Junction, Fla.
Norfolk & Western.	East line of Starke County, Ind. (west of Burr Oak, Ind.).	East yard limits of Fort Wayne, Ind.
Do.....	East line of La Porte County, Ind. (east of Dillon, Ind.).	Toledo, Ohio.
Do.....	Illinois-Indiana State line (west of State line, Ind.).	Toledo, Ohio, and Ohio-Michigan State line (near Munson, Mich.).
Do.....	Ohio-Michigan State line (near Munson, Mich.).	Oakwood Junction, Mich. <sup>1</sup>
Do.....	East line of La Porte County, Ind. (west of Walkerton, Ind.).	South yard limits of Peru, Ind.
Do.....	Illinois-Indiana State line (west of Frankfort, Ind.).	East yard limits of Frankfort, Ind.
Do.....	Illinois-Indiana State line (west of Cayuga, Ind.).	Frankfort, Ind.
Van Central.	Michigan-Indiana State line (south of Grand Beach, Mich.).	Niles, Mich. <sup>1</sup>
Do.....	East line of La Porte County, Ind. (west of Elkhart, Ind.).	Tower B (4.0 miles) east of the west line of Elkhart County, Ind.
Do.....	East line of Starke County, Ind. (west of Donaldson, Ind.).	Fort Wayne, Ind.
Do.....	South line of Starke County, Ind. (north of Denham, Ind.).	Logansport, Ind.

See footnotes at end of table.

Railroad	From—	To—
Do.....	East line of Jasper County, Ind. (east of Remington, Ind.).	Logansport, Ind.
Do.....	The intersection of the north line of Benton County, Ind., and Illinois-Indiana State line (northwest of Sheff, Ind.).	Sheff, Ind.
Do.....	South line of Newton County, Ind. (north of Sheff, Ind.).	Illinois-Indiana State line (northeast of Danville, Ill.).
Do.....	Illinois-Indiana State line (west of St. Marys of the Woods, Ind.).	Ringo Tower, Ind. (Terre Haute).
Do.....	Illinois-Indiana State line (east of Farrington, Ill.).	Ringo Tower, Ind. (Terre Haute).
Peoria & Eastern.	Illinois-Indiana State line (east of Danville, Ill.).	West yard limits of Indianapolis, Ind.
Soo Line.....	Michigan-Wisconsin State line.	United States-Canada Boundary (near Sault Ste. Marie, Mich.) <sup>1</sup>
Southern.....	East line of Pike County, Ind. (west of Stapleton, Ind.).	Junction with Baltimore & Ohio near Vincennes Street, New Albany, Ind.

<sup>1</sup> Effective only from 2 a.m. on the last Sunday in October to 2 a.m. on the last Sunday in April; exception unnecessary during the remainder of year because during that period Michigan time is not advanced and therefore is the same as central standard time (advanced).

(2) Lines west of boundary included in eastern zone. Those parts of the following lines of railroad located west of the zone boundary line described in this section, are, for operating purposes only, excepted from the central time zone and included within the eastern standard time zone:

Railroad	From—	To—
Apalachicola Northern.	Apalachicola, Fla., and Apalachicola River.	Port St. Joe, Fla.
Central of Georgia.	Georgia-Alabama State line (west of Hilton, Ga.).	Dothan, Ala.
Chesapeake & Ohio.	South line of Starke County, Ind. (north of Beardstown, Ind.).	Griffith, Ind.
Do.....	Michigan-Indiana State line (south of New Buffalo, Mich.).	Porter and La Crosse, Ind. <sup>1</sup>
Louisville & Nashville.	West line of Taylor County, Ky. (east of Whitewood, Ky.).	Greensburg, Ky.
Monon.....	North line of Pulaski County, Ind. (south of San Pierre).	Michigan City, Ind. and Hammond, Ind.
Do.....	West line of White County, Ind. (west of Lee, Ind.).	Hammond, Ind. and Michigan City, Ind.
Penn Central.....	South line of Daviess County, Ind. (east of Potosi, Ind.).	Ashby, Ind.

See footnotes at end of table.

Railroad	From—	To—
Seaboard Coast Line.	Georgia-Alabama State line (west of Esom, Ga.).	Birmingham, Ala.
Do.....	Georgia-Alabama State line (west of Omaha, Ga.).	Montgomery, Ala.
Do.....	Georgia-Alabama State line (near Pyne, Ga.).	Parkwood, Ala.
Do.....	Georgia-Alabama State line (west of Suffolk, Ga.).	Abbeville, Elba, and Montgomery, Ala.
Tennessee, Alabama & Georgia.	Georgia-Alabama State line (southwest of Monio, Ga.).	Gadsden, Ala.

<sup>1</sup> Effective only from 2 a.m. on the last Sunday in October to 2 a.m. on the last Sunday in April; exception unnecessary during the remainder of the year because during that period Michigan time is not advanced and therefore is the same as central standard time (advanced).

(3) *Indiana and Ohio operations included in Michigan nonadvanced time.* Those parts of the following lines of railroad located east of the zone boundary described in this section, are, for operating purposes only, excepted from the eastern standard time zone to permit operations in accordance with Michigan nonadvanced eastern standard time during the period from 2 a.m. on the last Sunday in April to 2 a.m. on the last Sunday in October:

Railroad	From—	To—
Chesapeake & Ohio.	Michigan-Ohio State line (north of Alexis, Ohio).	Alexis, Ohio.
Detroit & Toledo Shore Line.	Michigan-Ohio State line (north of Toledo, Ohio).	Toledo, Ohio.
Penn Central.....	Michigan-Indiana State line (north of Vistula, Ind.).	Tower B, Elkhart, Ind.
Do.....	Michigan-Ohio State line (north of Alexis, Ohio).	Alexis, Ohio.
Do.....	Michigan-Indiana State line (south of Niles, Mich.).	South Bend, Ind.
Do.....	Michigan-Indiana State line (south of Sturgis, Mich.).	Fort Wayne, Ind.

(4) *Michigan operations excepted from Michigan nonadvanced eastern standard time.* Those parts of the following lines of railroad located within the State of Michigan and east of the zone boundary described in this section, are, for operating purposes only, excepted from the requirement to operate in accordance with Michigan's nonadvanced eastern standard time and are authorized to operate on eastern standard time (advanced) during the period from 2 a.m. on the last Sunday in April to 2 a.m. on the last Sunday in October.

Railroad	From—	To—
Ann Arbor.....	Ohio-Michigan State line (north of Alexis, Ohio).	Owosso, Mich.
Detroit, Toledo & Ironton.	Ohio-Michigan State line (north of Metamora, Ohio).	Detroit and Dearborn, Mich.
Do.....	Ohio-Michigan State line (north of Denson, Ohio).	Tecumseh, Mich.

Railroad	From—	To—
Do.....	Ohio-Michigan State line (north of Alexis, Ohio) (over the tracks of the Ann Arbor Railroad).	Diann, Mich.
Penn Central.....	Indiana-Michigan State line (north of Ray, Ind.).	Jackson, Mich.
Do.....	White Pigeon Junction, Mich.	Jonesville, Mich.
Do.....	Litchfield, Mich.	Oesen, Mich.
Do.....	Bankers, Mich.	North Adams, Mich.
Do.....	Morenci, Mich.	Palmyra, Mich.
Do.....	Clayton, Mich.	Ida, Mich.
Do.....	Ohio-Michigan State line (south of Ottawa Lake, Mich.).	Clinton, Mich.
Do.....	Ohio-Michigan State line (north of Alfordton, Ohio).	Jackson, Mich.
Do.....	Cement City, Mich.	Brooklyn, Mich.

(h) *Municipalities on boundary line.* All municipalities located upon the zone boundary line described in this section are in the central standard time zone, except Apalachicola, Fla., which is in the eastern standard time zone.

§ 71.6 Central zone.

The third zone, the central standard time zone, includes that part of the United States that is west of the boundary line between the eastern and central standard time zones described in § 71.5 and east of the boundary line between the central and mountain standard time zones described in § 71.7.

§ 71.7 Boundary line between central and mountain zones.

(a) *Montana-North Dakota.* Beginning at the junction of the Montana-North Dakota boundary with the boundary of the United States and Canada southerly along the Montana-North Dakota boundary to the Missouri River; thence southerly and easterly along the middle of that river to the midpoint of the confluence of the Missouri and Yellowstone Rivers; thence southerly and easterly along the middle of the Yellowstone River to the north boundary of T. 150 N., R. 104 W.; thence east to the northwest corner of T. 150 N., R. 102 W.; thence south to the southwest corner of T. 149 N., R. 102 W.; thence east to the northwest corner of T. 148 N., R. 102 W.; thence south to the northwest corner of T. 147 N., R. 102 W.; thence east to the southwest corner of T. 148 N., R. 101 W.; thence south to the middle of the Little Missouri; thence easterly and northerly along the middle of that river to the midpoint of its confluence with the Missouri River; thence southerly and easterly along the middle of the Missouri River to the north line of Morton County; thence west along the north line of Morton County to the northwest cor-

ner of T. 140 N., R. 83 W.; thence south to the southwest corner of T. 140 N., R. 83 W.; thence east to the southeast corner of T. 140 N., R. 83 W.; thence south to the middle of the Heart River; thence easterly and northerly along the middle of that river to the southern boundary of T. 139 N., R. 82 W.; thence east to the middle of the Heart River; thence southerly and easterly along the middle of that river to the midpoint of the confluence of the Heart and Missouri Rivers; thence southerly and easterly along the middle of the Missouri River to the northern boundary of T. 130 N., R. 80 W.; thence west to the northwest corner of T. 130 N., R. 80 W.; thence south to the North Dakota-South Dakota boundary; thence easterly along that boundary to the middle of the Missouri River.

(b) *South Dakota*. From the junction of the North Dakota-South Dakota boundary with the Missouri River southerly along the main channel of that river to the crossing of the Chicago & North Western Railway near Pierre; thence southwesterly to the northeast corner of T. 1 S., R. 28 E. in Jones County; thence south along the range line between Rs. 28 and 29 E. to the north line of Mellette County; thence east along the north line of Mellette County to the west line of Tripp County; thence south along the west line of Tripp County to the North Dakota-Nebraska boundary.

(c) *Nebraska*. From the junction of the west line of Tripp County, South Dakota with the South Dakota-Nebraska boundary west along that boundary to the west line of R. 30 W.; thence south along the range line between Rs. 30 and 31 W. to the southwest corner of sec. 19, T. 33 N., R. 30 W.; thence easterly along section lines to the northeast corner of sec. 29, T. 33 N., R. 30 W.; thence southerly along section lines with their offsets to the northeast corner of sec. 17, T. 32 N., R. 30 W.; thence westerly along section lines to the northwest corner of sec. 18, T. 32 N., R. 30 W.; thence southerly along the range line to the southwest corner of T. 31 N., R. 30 W.; thence easterly along the township line to the northeast corner of T. 30 N., R. 30 W.; thence southerly along the range line to the southwest corner of T. 29 N., R. 29 W.; thence westerly along the township line to the northwest corner of sec. 4, T. 28 N., R. 30 W.; thence southerly along section lines to the southwest corner of sec. 33, T. 28 N., R. 30 W.; thence easterly along the township line to the northeast corner of sec. 4, T. 27 N., R. 30 W.; thence southerly along section lines to the southwest corner of sec. 22, T. 26 N., R. 30 W.; thence easterly along section lines to the southeast corner of sec. 24, T. 26 N., R. 30 W.; thence southerly along the range line to the north line of Thomas County; thence westerly along the north line of Thomas County to the west line of Thomas County; thence south along the west line of Thomas

County to the north line of McPherson County; thence west along the north line of McPherson County to the west line of McPherson County; thence south along the west line of McPherson County to the north line of Keith County; thence east along the north line of Keith County to the west line of Lincoln County; thence south along the west line of Lincoln County to the north line of Hayes County; thence west along the north line of Hayes County to the west line of Hayes County; thence south along the west line of Hayes and Hitchcock Counties to the Nebraska-Kansas boundary.

(d) *Kansas-Colorado*. From the junction of the west line of Hitchcock County, Nebr., with the Nebraska-Kansas boundary westerly along that boundary to the northwest corner of the State of Kansas; thence southerly along the Kansas-Colorado boundary to the north line of Sherman County, Kans.; thence easterly along the north line of Sherman County to the east line of Sherman County; thence southerly along the east line of Sherman County to the north line of Logan County; thence westerly along the north line of Logan County to the east line of Wallace County; thence southerly along the east line of Wallace County to the north line of Wichita County; thence westerly along the north line of Wichita County to the east line of Greeley County; thence southerly along the east line of Greeley County to the north line of Hamilton County; thence easterly along the north line of Hamilton and Kearny Counties to the junction of the east line of R. 36 W.; thence southerly along the range line between Rs. 35 and 36 W. with its offset to the south line of Kearny County; thence westerly along the south line of Kearny and Hamilton Counties to the Kansas-Colorado boundary; thence southerly along the Kansas-Colorado boundary to the junction of that boundary with the north boundary of the State of Oklahoma.

(e) *Oklahoma-Texas-New Mexico*. From the junction of the Kansas-Colorado boundary with the northern boundary of the State of Oklahoma westerly along the Colorado-Oklahoma boundary to the northwest corner of the State of Oklahoma; thence southerly along the west boundary of the State of Oklahoma and the west boundary of the State of Texas to the southeast corner of the State of New Mexico; thence westerly along the Texas-New Mexico boundary to the east line of Hudspeth County, Tex.; thence southerly along the east line of Hudspeth County, Tex., to the boundary between the United States and Mexico.

(f) *Operating exceptions*—(1) *Lines east of boundary excepted from central zone*. Those parts of the following lines of railroad, located east of the zone boundary line described in this section, are, for operating purposes only, excepted from the central standard time zone and are included within the mountain standard time zone:

Railroad	From--	To--
Atchison, Topeka, & Santa Fe.	East line of T. 24 S., R. 36 W., Kearny County, Kans.	Scott City and Dodge City, Kans.
Do.....	Kansas-Colorado State line.	Satanta, Kans.
Do.....	Colorado-Oklahoma State line.	Dodge City, Kans., via Boise City, Okla.
Chicago, Burlington, & Quincy.	East line of Hooker County, Nebr.	Ravenna, Nebr.
Do.....	East line of Perkins County, Nebr.	Heldrege, Nebr.
Do.....	East line of Chase County, Nebr.	McCook, Nebr.
Do.....	East line of Dundey County, Nebr.	Do.
Chicago, Milwaukee, St. Paul & Pacific.	Missouri River, S. Dak.	Mobridge, S. Dak.
Chicago & Northwestern.	West line of T. 34 N., R. 30 W., Cherry County, Nebr.	Long Pine, Nebr.
Great Northern..	Montana-North Dakota State line.	Williston, N. Dak.
Do.....	Yellowstone River, N. Dak.	Waterford City, N. Dak.
Northern Pacific.	East line of T. 138 N., R. 83 W., Morton County, N. Dak.	Mandan, N. Dak.
Do.....	North line of T. 140 N., R. 81 W., Morton County, N. Dak.	Do.
Do.....	South line of T. 139 N., R. 81 W., Morton County, N. Dak.	Do.
Union Pacific.....	East line of Keith County, Nebr.	North Platte, Nebr.
Do.....	East line of Wallace County, Kans.	Ellis, Kans.

(2) *Lines west of boundary included in central zone.* Those parts of the following lines of railroad located west of the zone boundary line described in this section are, for operating purposes only, excepted from the mountain standard time zone and are included within the central standard time zone:

Railroad	From--	To--
Atchison, Topeka, & Santa Fe.	Texas-New Mexico State line (near Texico, N. Mex.).	Clovis, N. Mex.
Chicago, Rock Island & Pacific.	Texas-New Mexico State line.	Tucumcari, N. Mex.
Do.....	West line of Thomas County, Kans.	Goodland, Kans.
Missouri.....	West line of Wichita County, Kans.	Pueblo, Colo.
See Line.....	Montana-North Dakota State line.	Whitetail, Mont.
Southern Pacific.	East line of Hudspeth County, Tex.	El Paso, Tex.
Texas & Pacific.	do.....	Do.
Texas-New Mexico.	Texas-New Mexico State line.	Lovington, N. Mex.

(g) *Points on boundary line.* All municipalities located upon the zone boundary line described in this section are in the mountain standard time zone.

except Murdo, S. Dak., which is in the central standard time zone.

#### § 71.8 Mountain zone.

The fourth zone, the mountain standard time zone, includes that part of the United States that is west of the boundary line between the central and mountain standard time zones described in § 71.7 and east of the boundary line between the mountain and Pacific standard time zones described in § 71.9.

#### § 71.9 Boundary line between mountain and Pacific zones.

(a) *Montana-Idaho-Oregon.* From the junction of the Idaho-Montana boundary with the boundary between the United States and Canada southerly along the Idaho-Montana boundary to the boundary line between Idaho County, Idaho, and Lemhi County, Idaho; thence southwesterly along the boundary line between those two counties to the main channel of the Salmon River; thence westerly along the main channel of the Salmon River to the Idaho-Oregon boundary; thence southerly along that boundary to the boundary line between Baker County, Oreg., and Malheur County, Oreg.; thence westerly along the north line of Malheur County to the northwest corner of Malheur County; thence southerly along the west line of Malheur County to the southwest corner of T. 35 S., R. 37 E.; thence east to the Idaho-Oregon boundary; thence south along that boundary to the southwest corner of the State of Idaho; thence easterly along the Idaho-Nevada boundary to the northeast corner of the State of Nevada.

(b) *Utah-Nevada-Arizona-California.* From the northeast corner of the State of Nevada southerly along the Utah-Nevada boundary, the Nevada-Arizona boundary, and the Arizona-California boundary to the boundary between the United States and Mexico.

(c) *Operating exceptions—(1) Lines east of boundary excepted from mountain zone.* Those parts of the following lines of railroad located east of the zone boundary line described in this section, are, for operating purposes only, excepted from the mountain standard time zone and are included within the Pacific standard time zone:

Railroad	From--	To--
Great Northern..	Troy, Mont.....	Montana-Idaho State line.
Northern Pacific.	Paradise, Mont.....	Do.
Southern Pacific..	Ogden, Utah.....	Utah-Nevada State line.
Western Pacific...	Salt Lake City, Utah.	Do.
Do.....	Burmester, Utah..	Warner, Utah.

(2) *Lines west of boundary included in mountain zone.* Those parts of the following lines of railroad located west of the zone boundary line described in this section, are, for operating purposes only, excepted from the Pacific standard time zone and are included in the mountain standard time zone:

Railroad	From--	To--
Atchison, Topeka, & Santa Fe.	Colorado River...	Southern limits of Needles, Calif.
Chicago, Milwaukee, St. Paul & Pacific.	Montana-Idaho State line.	Avery, Idaho.
Union Pacific.....	Idaho-Nevada State line near Idavada, Idaho.	Wells, Nevada.
Do.....	West line of Malheur County, Oreg.	Burns, Oreg.

(d) *Points on boundary line.* All municipalities located upon the zone boundary line described in this section are in the mountain standard time zone.

§ 71.10 Pacific zone.

The fifth zone, the Pacific standard time zone, includes that part of the United States that is west of the boundary line between the mountain and Pacific standard time zones described in § 71.9 and east of 137° W. longitude.

§ 71.11 Yukon zone.

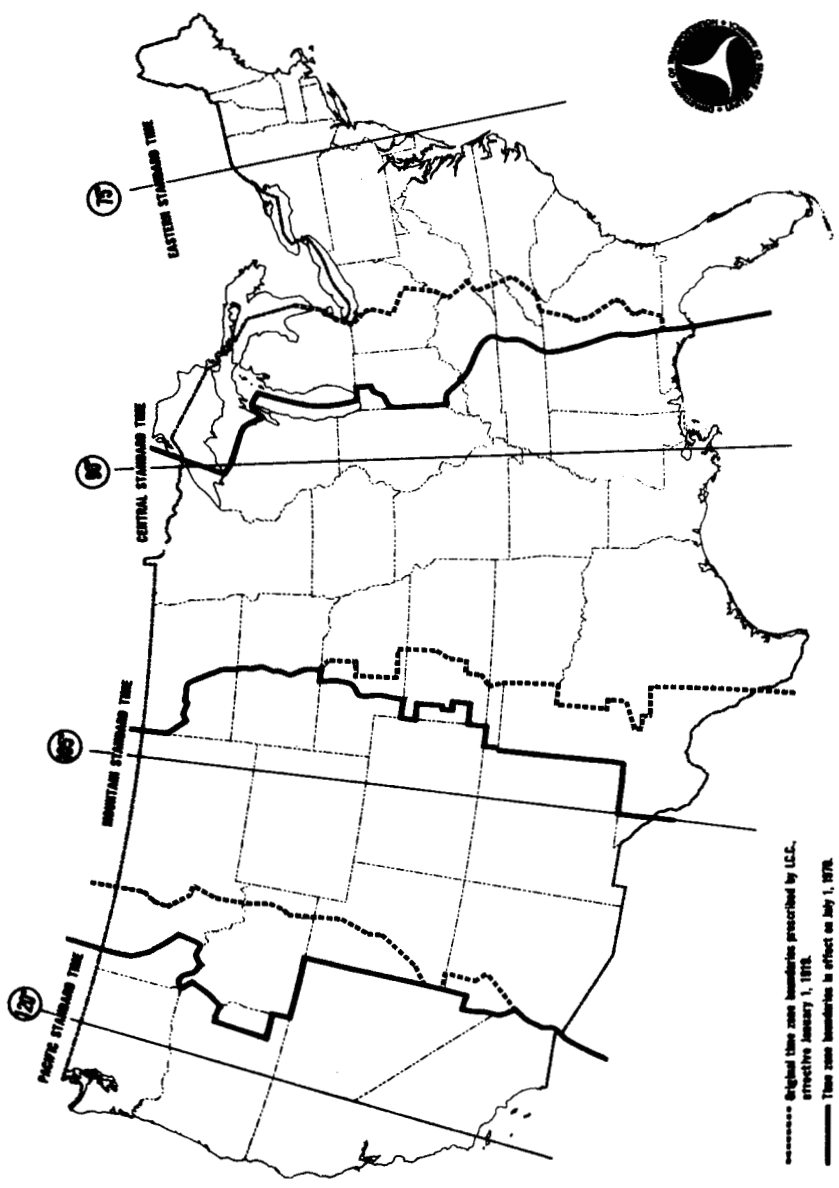
The sixth zone, the Yukon standard time zone, includes that part of the United States that is between 137° W. longitude and 141° W. longitude.

§ 71.12 Alaska-Hawaii zone.

The seventh zone, the Alaska-Hawaii standard time zone, includes that part of the United States that is between 141° W. longitude and 162° W. longitude and including all of the State of Hawaii.

§ 71.13 Bering zone.

The eighth zone, the Bering standard time zone, includes that part of the United States that is between 162° W. longitude and 172°30' W. longitude and that part of the Aleutian Islands that is west of 172°30' W. longitude, but does not include any part of the State of Hawaii.



----- Original time zone boundaries prescribed by U.S.C. effective January 1, 1898.  
 \_\_\_\_\_ Time zone boundaries in effect as of July 1, 1978.

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