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PART II
CLASSIFIED SECTION
REPORT ON STUDY
OF
UNITED STATES GOVERNMENT WIND TUNNELS

SUPPLY OF
WIND TUNNEL TESTING TIME
VERSUS DEMAND

WITH
RELATED CHARTS AND EXHIBITS
APRIL 1954

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DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW (DASD-PA)
DEPARTMENT OF DEFENSE

DECLASSIFIED BY
D O V S D (REAT) - AL. D. MAID
10 MAY 1985
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SUPPLY OF WIND TUNNEL TESTING TIME

VERSUS DEMAND

The balance between the supply of existing and anticipated wind tunnel testing time and the demand for that time is a fundamental consideration in the determination of (1) whether proposed construction is justified and (2) whether the operation of individual facilities should be expanded or curtailed.

In examining supply versus demand it must be borne in mind that any new facility which represents a technological advance over those previously available will create demand by generating new ideas, techniques, and uses. Another basic principle is that proposed major facilities do not become available overnight: several years will elapse between the initial planning and the funding, constructing, and calibrating stages. Thus, urgent demand for a new facility must be and often is satisfied in an existing facility less suitable for the purpose or by other means such as flight tests and aerodynamic tracks.

Supply and demand have been considered from the standpoint of facilities owned and requirements generated by the various military departments and by National Advisory Committee on Aeronautics (NACA). Privately owned facilities were considered only to the extent they are significant and are available to meet a portion of military requirements in particular classes of tunnels. Industrial demands for Government wind tunnels as reported to us by members of industry have been used only to verify the reasonableness

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of the estimates submitted by the agencies; otherwise they are not taken into account in our discussions and charts because such demands are primarily of military origin and have thus been included by the military departments as part of their estimated requirements.

Officials of NACA have reported that all NACA tunnels (other than the Unitary Plan tunnels) can profitably be devoted entirely to NACA's primary function of basic research studies. Our charts therefore do not reflect NACA requirements, since in every instance those requirements would equal NACA supply. As a practical matter, however, NACA does satisfy a portion of essential military demand that cannot be met in either military or private tunnels. Whether the remaining capacity of NACA tunnels is sufficient to satisfy its research needs after meeting these essential military requirements is problematical, particularly in fiscal years 1954 and 1955.

To establish the supply of wind tunnel testing time we first obtained experience factors from the tunnel operators for fiscal years 1952 and 1953 in the various classes of tunnels grouped according to speed and size. The fiscal year 1953 supply was then assumed to be essentially the supply that will exist in fiscal years 1954, 1955, and 1956, making due allowances for (1) the number of shifts each tunnel is operated, (2) unusual conditions that may limit or restrict operations, and (3) new facilities and modified facilities that will become available during this period. Computations are based on the assumption that increased funds will

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be made available for the operation of facilities under construction.

To establish demand, reports were received from various organizations in the Department of Defense as to actual time used in fiscal year 1953 and requirements anticipated for fiscal years 1954, 1955, and 1956, summarized according to the various classes of tunnels for which supply information was obtained. It must be understood that demand is nebulous and constantly subject to revision in the light of technological advances, changes in materiel emphasis, and developments in test programs. With this qualification in mind, plus the fact that we did not make a study to establish the validity of the data on requirements, we believe the following discussions to be sound representations of the status of supply versus demand in the several tunnel categories.

Subsonic

There does not appear to be a problem of supply in the subsonic class. Most agencies reported that their requirements were met in fiscal years 1952 and 1953. Although no increase is anticipated, sufficient untapped capacity exists to handle a substantial increase in demand, since the majority of the tunnels in this group are being operated on a one-shift basis. It should be pointed out, however, that there is a real possibility that some subsonic tunnels will be closed to provide sufficient personnel for the operation of new, more advanced facilities. But there are many subsonic tunnels owned by industry and universities that are available for both research and development testing to which otherwise unsatisfied requirements can be shifted if the need arises.

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Transonic

At present, testing time in large transonic tunnels is at a premium (chart 1). All of the military organizations reported inability to satisfy their requirements in fiscal year 1953, and all departments indicated increased demands for fiscal years 1954 and 1955. NACA tunnels in this speed range have been used about 50 percent of the time for military development tests; the remaining time has been devoted to research effort. The current shortage will be somewhat alleviated when the new 8-foot tunnel is placed in full operation at NACA-Langley laboratory in fiscal year 1954 and when the transonic tunnel at the David Taylor Model Basin becomes available sometime during fiscal year 1955. Several additional Government and industry tunnels are being constructed or modified and will be available by the end of fiscal year 1956. It appears now that there will not be a satisfactory balance between supply and demand until that time.

Supersonic

Substantially all military requirements for testing in small supersonic tunnels (test sections 24 inches and less) were met in fiscal year 1953. Some increase in demand is anticipated for pressurized tunnels in this class; the capacity of continuous-operating pressurized tunnels on a one-shift basis will be adequate without considering the supply of intermittent tunnels (chart 2). At present there appears to be an overly generous supply of small pressurized supersonic tunnels. The supply of nonpressurized tun-

nels (continuous and intermittent) will remain approximately in balance with demand for the next several years; these too are operated on a one-shift basis (chart 3).

All currently operating supersonic tunnels over two feet in size are at NACA laboratories (chart 4). The Air Force and the Bureau of Aeronautics have substantial requirements for development testing in these large supersonic tunnels. Approximately 50 and 75 percent of their respective demands for tunnels 2 to 6 feet in size were not satisfied in fiscal year 1953. For tunnels 6 feet and larger the requirements of the Air Force were met in fiscal year 1953, but the Bureau of Aeronautics was able to satisfy only 12 percent of its requirements in this class. It is expected that military requirements for large supersonic tunnels will more than double within two years. However, the operation of the NACA Unitary tunnels on a contemplated three-shift basis will provide a more than adequate supply to meet these enlarged demands by fiscal year 1956. The large NACA tunnels (other than Unitary) should then be available entirely for research testing, and some time should be available for this purpose in the NACA-Unitary tunnels. Additional supply for development testing will be available in fiscal year 1956 with the completion of the 40-inch tunnel at the Arnold Engineering Development Center (AEDC).

Hypersonic

The work being performed in hypersonic tunnels now is primarily research, this being a relatively new field of investiga-

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tion, but development requirements are expected to increase steadily. Existing hypersonic tunnels are, for the most part, restricted to research uses and have only limited usefulness for development testing because of their small size, limited Mach Number range, or both. Chart 5 shows the demand versus supply of small hypersonic tunnels.

Two hypersonic tunnels are being constructed primarily for development work by the Air Force at AEDC and by the Army at the Ballistics Research Laboratory. These are expected to be available in 1956 and 1957 respectively. Anticipated military demand will occupy these tunnels on a one-shift basis. At least two other hypersonic tunnels suitable for development work are planned by the military, and if constructed will be available sometime after fiscal year 1956.

A 40-inch hypersonic tunnel is partially constructed at AEDC but sufficient funds for its completion are not available at present. Requirements for large hypersonic testing are now small but it is reasonable to expect increases in fiscal year 1956 and thereafter.

Propulsion

At present there is no large transonic propulsion wind tunnel. The transonic circuit of the Propulsion Wind Tunnel at AEDC will be available by 1957, and it will more than satisfy all requirements now indicated for that time. In the large supersonic propulsion category, the only existing tunnel is at NACA-Lewis laboratory where the small military requirements can be readily satisfied in fiscal year 1954; thereafter demand is expected to

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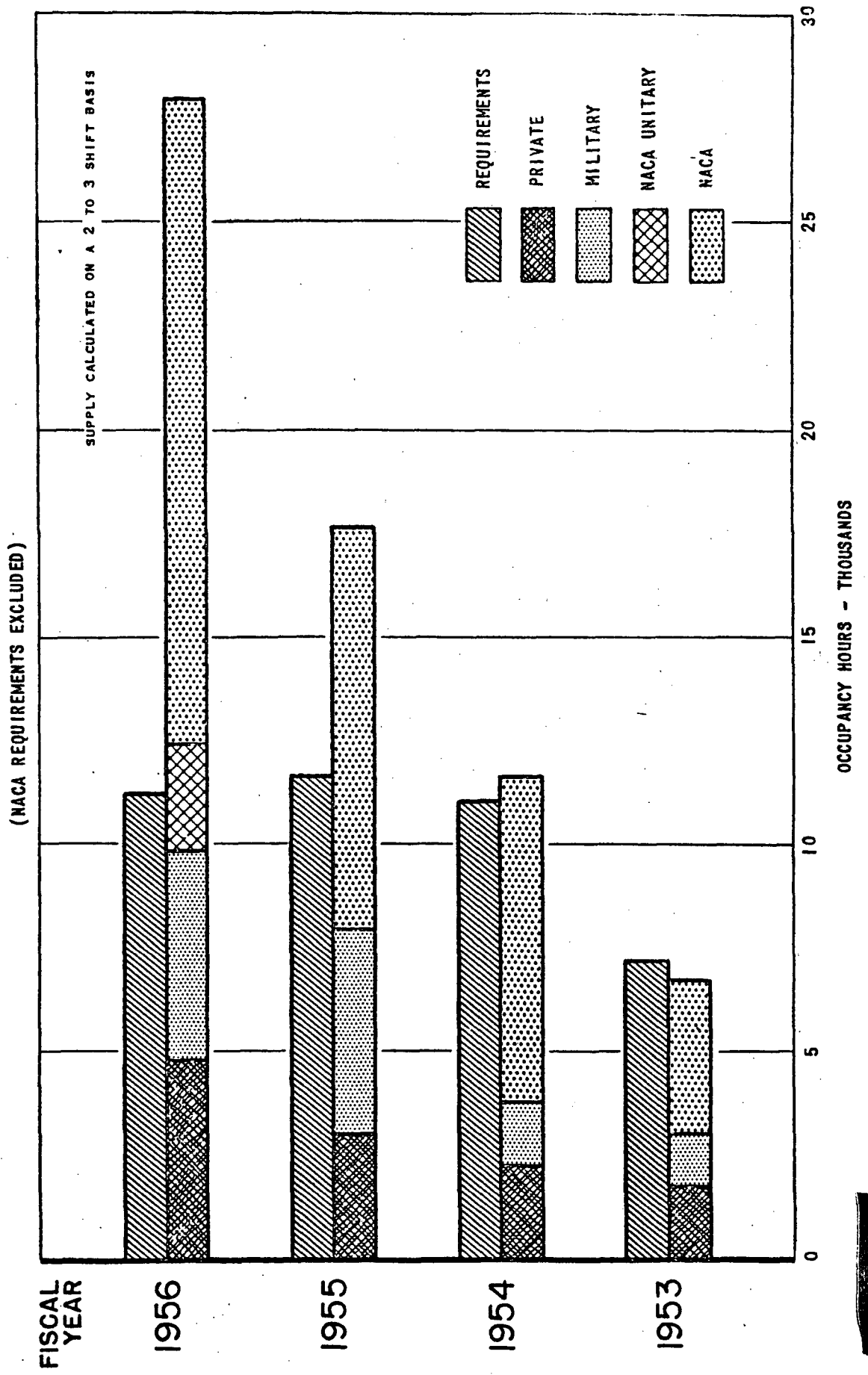
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increase (chart 6). The Unitary tunnel now under construction at the Lewis laboratory will provide more than enough time to meet estimated requirements for fiscal year 1956. The supersonic circuit of the Propulsion Wind Tunnel at AEDC is not yet fully funded, although partially constructed, and is not included in the supply picture. If completed as planned, it would become available in fiscal year 1959.

* * * * *

As long as special facilities are required for testing purposes to obtain technological advances in aeronautics, it will be necessary to conduct continual studies regarding the balance between supply and demand for testing time. Intermittent studies lacking continuity are not the answer to provide information assuring a timely, yet economical adequacy of testing capacity. The data for these studies of supply and demand should be based on well-defined and uniform terminology and principles; the data should be carefully analyzed at regular intervals and otherwise as the need arises. The Advisory Group that is recommended in the unclassified section of this report (see p. 74) should have the responsibility to provide the Congress with all necessary information in this connection.

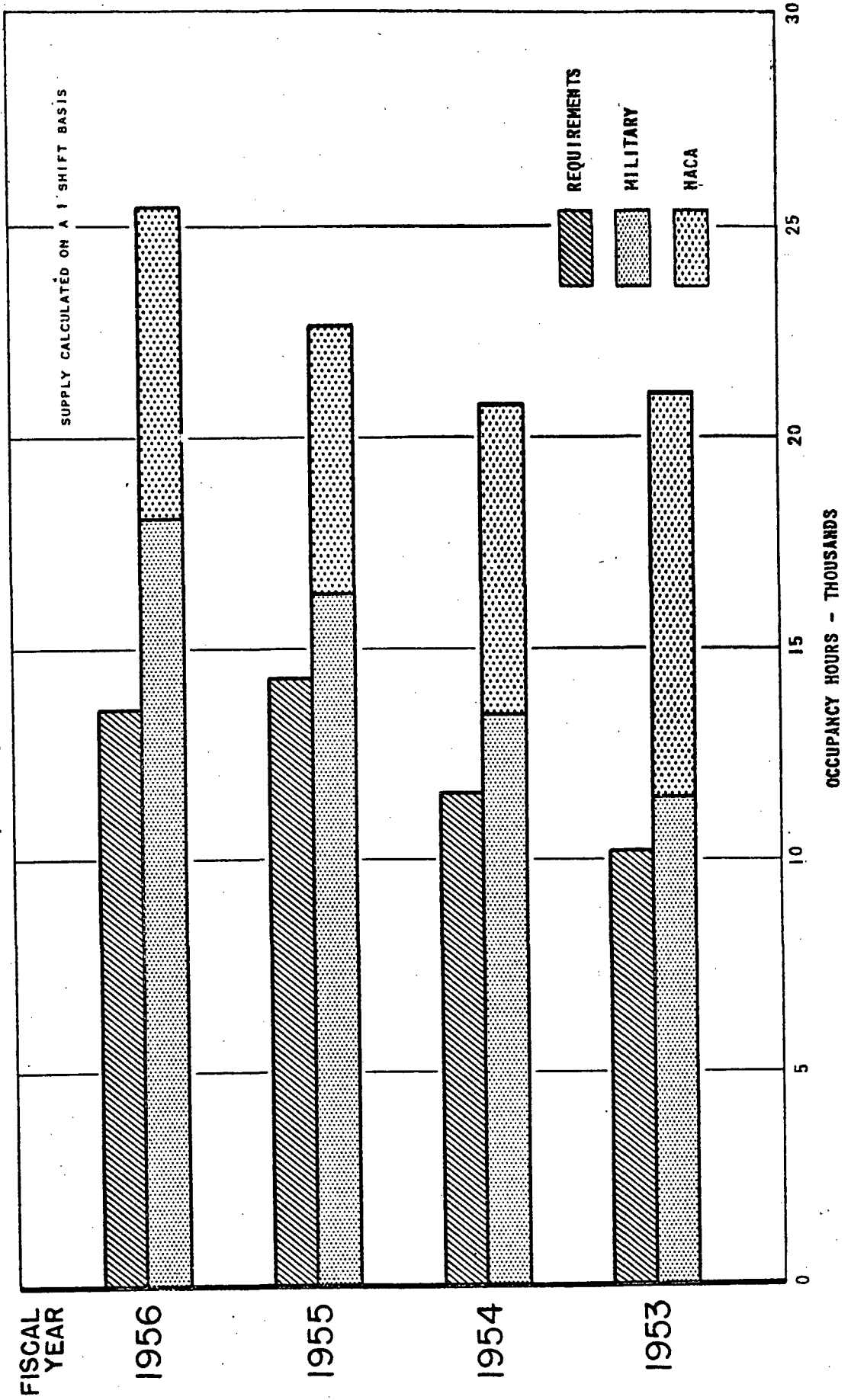
AVAILABLE OCCUPANCY HOURS VS ESTIMATED MILITARY REQUIREMENTS
LARGE TRANSONIC WIND TUNNELS - AERODYNAMIC
(TEST SECTIONS LARGER THAN 24" x 24")



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AVAILABLE OCCUPANCY HOURS VS ESTIMATED MILITARY REQUIREMENTS
SMALL SUPERSONIC WIND TUNNELS - PRESSURIZED
(9" X 9" THROUGH 24" X 24" TEST SECTIONS)

(NACA REQUIREMENTS EXCLUDED)



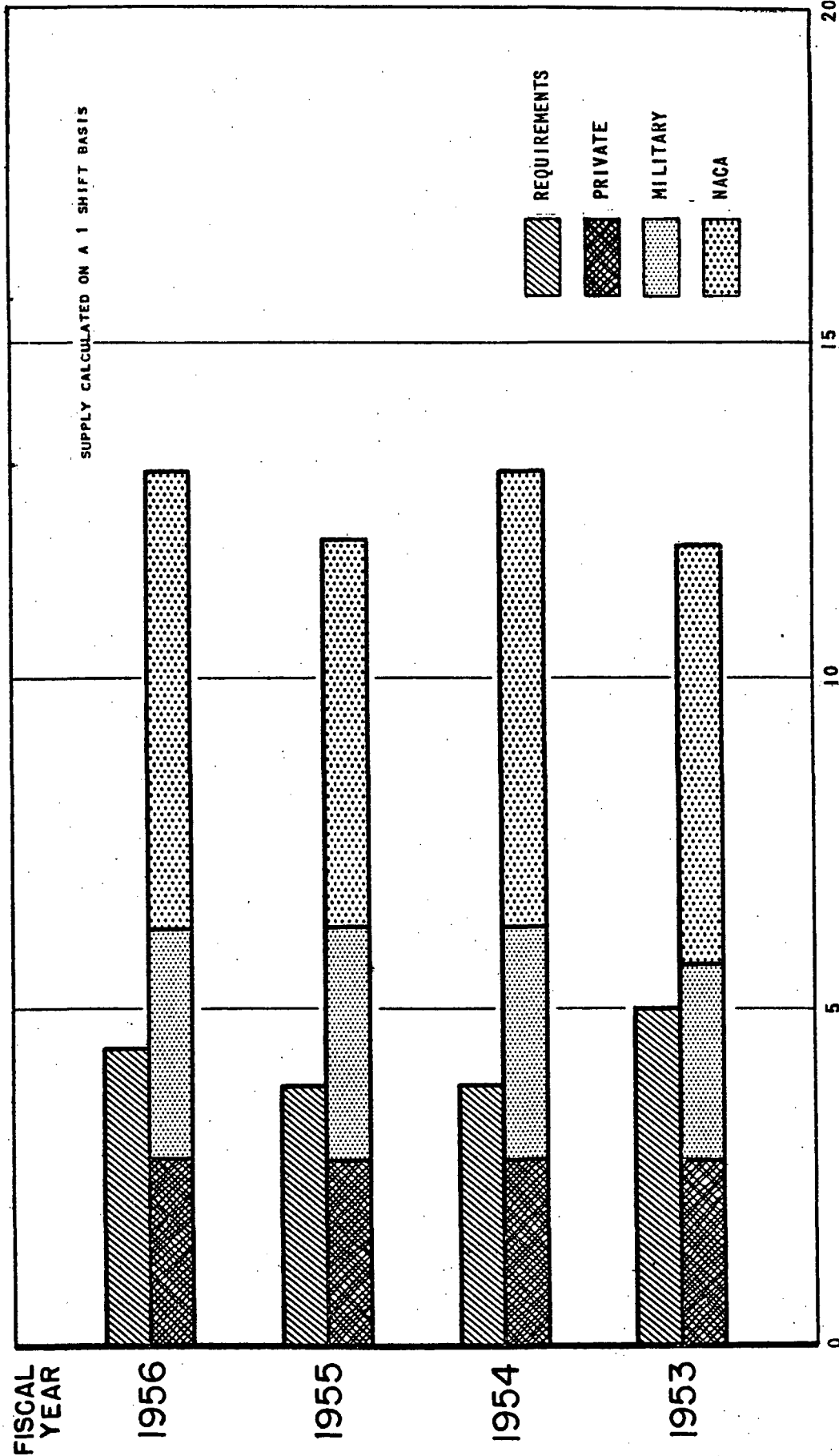
NOTE: INTERMITTENT TUNNELS NOT INCLUDED IN SUPPLY

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AVAILABLE OCCUPANCY HOURS VS ESTIMATED MILITARY REQUIREMENTS
SMALL SUPERSONIC WIND TUNNELS - NON-PRESSURIZED
(9" X 9" THROUGH 24" X 24" TEST SECTIONS)

(NACA REQUIREMENTS EXCLUDED)



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AVAILABLE OCCUPANCY HOURS VS ESTIMATED MILITARY REQUIREMENTS
LARGE SUPERSONIC WIND TUNNELS - AERODYNAMIC
(TEST SECTIONS LARGER THAN 24" X 24")

(NACA REQUIREMENTS EXCLUDED)



OCCUPANCY HOURS - THOUSANDS

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