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## **FACILITY CLASS 300 - RESEARCH, DEVELOPMENT, TEST AND EVALUATION FACILITIES**

Research, development, test and evaluation facilities include the buildings and other scientific structures and facilities used directly in theoretical and/or applied research, development, test and evaluation operations. Category code groups pertaining to these facilities are:

Category Code 310 thru 321    Research, Development, Test and Evaluation Buildings

Category Codes 371 and 390    Research Development, Test and Evaluation Structures

Associated facilities assigned function in support of research, development, test and evaluation are assigned appropriate codes such as Code 200 for normal maintenance, repair and overhaul purposes, Code 400 for warehouse, as opposed to storage functions, Code 600 for administrative facilities, Code 800 for utilities, and Code 900 for real estate.

### DEFINITION OF TERMS:

The following definitions of terms are used in the research criteria:

Gross Floor/Building Area. The total areas of all floors, measured between the exterior faces of outside walls. It includes full areas of basements, on-grade and above grade floors, service and equipment rooms, boiler plants and heater rooms, mezzanines, penthouses, enclosed passages and raised covered platforms. Excluded is all enclosed space with an average ceiling height of less than seven feet.

Net Floor Area. This is total gross floor area, less space taken up by outside walls, stair towers, elevator shafts, interior partitions, toilets, basements unsuited for specific use, permanent hallways, elevator machinery and machinery or equipment used for heating and/or ventilating the building. The net floor area does include special equipment bays peculiar to a particular laboratory function.

Prime Unit Generator. A special object (e.g., tow tank, wind tunnel, environmental chamber, multi-axis rate table) which tends to have the room built around it, rather than fitting into an existing room. Prime unit generators usually require "high bay" areas and often have overhead cranes or other heavy handling equipment associated with them.

Module. A basic unit that can function independently or be combined to form larger sizes. This term can be applied to an interior space such as a room, or to a piece of equipment, such as an Automatic Data Processing module.

NTG Factor (net to gross conversion factor) That factor which is used to convert a net floor area to a gross floor/building area (net floor area x NTG factor = gross floor/building area).

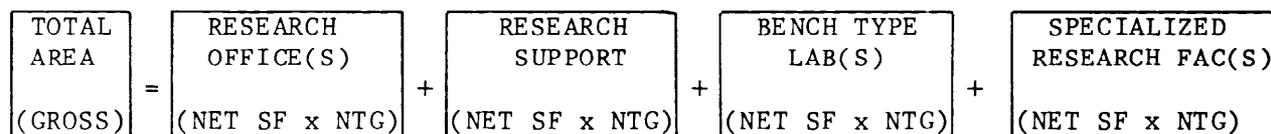
OVERALL METHODOLOGY:

The basic problem in planning any research facility is the same: how to meet an existing need while at the same time providing for flexibility and growth. Research by its very nature ranges from microscopic investigations to factory type testing set-ups. The methods described below provide a good prediction of the type and quantity of space that should be built to satisfy a specific program need, while at the same time allowing for flexibility to accommodate future RDT&E program.

In approaching any research facility planning project, it is advisable to break down the facility requirements into basic functional components. These components consist of:

1. Research Offices
2. Research Support
3. Bench Type Labs
4. Specialized Research Facilities

Not all of these components will be present in all research facilities. To arrive at total requirements for a facility, each of the components which are present should be looked at separately, using the appropriate method described in succeeding paragraphs. Net floor areas should be developed first for each component, and gross floor/building areas calculated for each by multiplying the net areas by the appropriate NTG conversion factor. The total space requirement for the research facility is obtained by adding the gross floor/building areas for each of the components, as diagrammed below:



There are three basic methods for developing and justifying net floor areas for research facilities. These consist of:

1. Architectural Method - This method consists of the development of scaled floor plans which depict a layout of equipment items within a required "envelope" of space. Such layouts should show the equipment as it should be placed within the space, which may not necessarily correspond to the manner in which such space is actually arranged in existing facilities. Such layouts should strive to be as efficient as possible, i.e., to include no space for which full utilization cannot be demonstrated.

2. Industrial Method - This method consists of identifying in a tabular format the net floor area required for each item of required equipment. When this method is used, the table should include three columns of information: (a) name of equipment item; (b) actual floor area occupied by the item, i.e., the size of its "footprint"; (c) size of the required working area within which the item sits, which permits all normal operations associated with the equipment as well as required services access to all sides. The sum of all the areas shown in item (c) will be the total net floor area for the space as a whole, and is equivalent to the "envelope" which would be shown graphically if the architectural method were used.

3. Use of Criteria - For many types of facilities, approved rules of thumb (criteria) may be used to generate net floor areas. These are identified in terms of space per person, space per module, etc., and have been incorporated wherever possible into the P-80 guidance. Use of criteria generally requires less time and effort than either of the other methods.

In developing requirements for research facilities, any of the above methods may be used or a combination of these methods to develop the net floor areas for each functional component of the research facility.

#### RECOMMENDED PROCEDURES, BY FUNCTIONAL COMPONENT:

RESEARCH OFFICE. Net floor areas for office spaces should be calculated by utilizing the criteria and guidance contained in category code 610 10. Gross floor/building areas should be developed using the NTG factors shown under this code. In utilizing the criteria, care must be taken to identify by administrative component, which personnel require office type space.

RESEARCH SUPPORT. The term "research support" is used to include lunch/locker spaces, libraries, auditoriums, etc., which may be required in direct support of an RDT&E function. It does not include storage, since requirements for this type of space are handled elsewhere. Studies have shown that space requirements for these types of space are similar, whether in support of a laboratory or other Navy uses. Therefore, the appropriate criteria may be used to calculate the requirements. If these criteria are to be used, refer to the appropriate category codes for guidance. Examples of such codes are:

Installation Restaurant	Category Code 740-26
Academic Instruction Building	Category Code 171-10
Applied Instruction Building	Category Code 171-20
Auditorium	Category Code 171-25

Net to gross conversion factors to be used for research support spaces are the same as for research offices.

BENCH TYPE LABS. The bench lab component of research facilities tends (if present) to be organized into repetitive modules. Because of the nature of research, one scientist may share a laboratory module with another scientist or, in some instances, one scientist may have a need for two or more dedicated labs. For planning purposes it is reasonable to identify what constitutes the basic lab module and justify the number of these modules on the overall number of scientists involved. (Note that photographic darkrooms and control rooms are treated as bench labs, not as support space.)

The basic laboratory module that is most adaptable to various types of research and which also works well within modern structural systems is 11.5 x 24 feet in size. This design allocates 276 square feet for net floor area per laboratory module.

The net to gross conversion factor to be used for bench type laboratories contains a built-in allowance for storage space, and laboratory support shop space. These are as follows:

For buildings supported by a central heating/cooling plant	1.35
For buildings containing their own HVAC equipment	1.65

SPECIALIZED RESEARCH FACILITIES. Specialized research facilities can be subdivided into three types: (1) Large Set-Ups of bench lab type activities which are too big to fit into a single bench lab module; (2) Systems Simulation, including automatic data processing laboratories, and data processing centers in support of other lab activities, and (3) One-of-a-kind facilities such as tow tanks, environmental chambers, and wind tunnels, etc.

A. For Large Set-Ups of relatively small and ordinary laboratory items arranged into a combination too large to fit into a single laboratory module, space allocation should be in multiples of a single 276 square foot bench lab module. These multiples usually range from 1 to 4 modules, only rarely exceeding 4 modules in size.

Large set-ups of a more-or-less permanent nature or involving only a few pieces of large equipment may be treated as one-of-a-kind items (see below). This is true even if the large set-up does not require the high ceiling typical of most one-of-a-kind facilities.

Net to gross conversion factors for large set-ups are the same as for bench lab spaces, and contain built-in allowances for storage and shop space. NTG factors to be used for large set-up spaces are as follows:

For building supported by a central heating/cooling plant	1.35
For buildings containing their own HVAC equipment	1.65

B. For Systems Simulation Facilities, allow 28 square feet of net floor area for each automatic data processing unit such as disc pack, tape drive, printer, and each relay rack of the processing units or console. Do not count supplemental air handlers, programmers' desks, or storage racks for tapes or cards--allowance for these is already included in the 28 square foot module. Specialized equipment associated with the ADP equipment (if any) is treated as one-of-a-kind equipment (see below). The net floor area for any specialized equipment should be added to that for the ADP units, and the same NTG factor applied as for office space (see category code 610-10).

C. One-of-a-Kind Facilities are built to house large and unique equipment such as wind tunnels, flow channels, shaker tables, environmental chambers, autoclaves, etc. A method for allocating space for one-of-a-kind facilities involves identifying the "Prime Unit Generator".

The prime unit generator is the item or assemblage of equipment which is the primary justification for the facility. Because of the specialized nature of these items, (which can be as small as a 6' diameter pressure vessel, or as large as a 20 x 30 x 50 foot space shuttle avionics test fixture) it is necessary to have some special rules for defining prime unit generators. These rules include the following:

1. Internal wind tunnels (where the entire tunnel is contained in a large room): Include compressors and/or suckers or reservoir vessels inside the building along with the tunnel tube itself.

2. External wind tunnels (where most of the tube is outside and only a working chamber is housed inside the building): Do not include any mechanism which is outside the building. Do include the entire working chamber, even if one wall of the chamber constitutes or is in contact with the outside wall of the building.

3. Tow tanks/flow channels/turning basins: Include in the prime unit generator all fundamentally necessary equipment which is inside the building and essential to the operation of the tank, channel, etc. Examples are pumps with flow channels, and wave making mechanisms with turning basins.

4. Irradiation equipment including X-ray: Include as a part of the prime unit generator power generation equipment, (as with wind tunnels), flow channels, etc. For track mounted units, include the entire track as part of the prime unit generator. For remote controlled units operating in a shielded room, treat the room only as a prime unit generator, and the controls as bench lab if in a control "booth", or a control console if freestanding outside the shielded irradiation room proper.

5. Control consoles: If freestanding in an otherwise open area, add 4 feet or clearance to working side and use the bench lab NTG. If in a separate room devoted exclusively to the control function, treat the entire room as a bench laboratory.

6. Internal aisles and walk space in specialized research facility areas, and within bench labs are not counted as circulation corridors, but are allowed for in the NTG factor.

7. General case. For RDT&E equipment and installations not specifically discussed above, treat the primary functional unit, and any unique "custom tailored" ancillaries as the prime unit generator. Other support items of a more nearly off-the-shelf nature are not counted as part of the prime unit generator but allowed for in the NTG factor.

After the footprint (floorplan area) of the prime unit generator is identified, a 6 foot working clearance is provided on all sides. For irregular shaped items some smoothing of the outline should be allowed to simplify calculation.

Note that the 6 foot working clearance is a theoretical space allocation tool, not intended to reflect realistic working requirements. Note, too, that in cases where the equipment is close to a building wall, the 6 foot clearance may extend outside the building wall, but is still counted in determining the required net floor area.

The total area of the prime unit generator, and its 6 foot working clearance is called the "Working Net" for that item.

The net to gross conversion factor applied to the working net of one-of-a-kind facilities depends upon the type of heating service provided to the building:

For buildings support by a central heating/cooling plant	1.5
For buildings containing their own HVAC equipment	2.2

As an alternative to the above procedure, a scaled floor plan (Architectural Method) may be developed and provided as justification for the space requirement.

SUMMARY OF RECOMMENDED PROCEDURES:

For convenience, a brief summary is provided:

1. Offices - Use criteria for category code 610 10.
2. Research Support - Use criteria for the appropriate category codes to obtain net floor area. Use NTG factor for the category code 610 10 administrative space.
3. Bench Labs - Use 276 square foot module. Treat darkrooms and control rooms as bench lab space. The NTG factor includes allowance for storage and direct shops support, and varies with the type of building heating system.
4. Specialized Research Facilities -
  - (a) Large Set-Ups: Use multiple of bench lab module. Use same NTG factors as for bench labs.
  - (b) Systems Simulation: Use 28 square foot module for each piece of ADP equipment. Add area for any specialized equipment (which is treated as one-of-a-kind equipment). Use the same NTG factor as for category code 610 10 space.
  - (c) One-of-a-kind facilities: Identify prime unit generator. Add 6 foot working space to obtain working net. The NTG factor will vary with the type of building heating system.
5. Alternative Methods: The Architectural Method and the Industrial Method may also be used, if applicable, to a particular research requirement.

CATEGORY CODE DESIGNATION:

After a determination is made of the gross floor/building area, a specific category can be assigned to the total space, based on the primary anticipated use for the facility. As a general guideline, offices and support areas which are directly related to a particular type of research activity, carry the same category code as the laboratory areas themselves.