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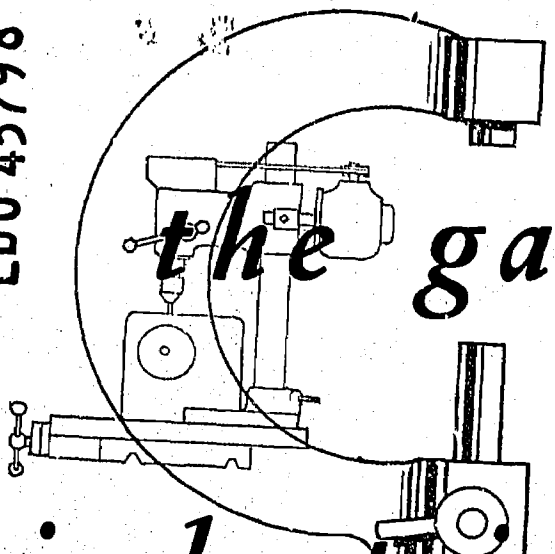
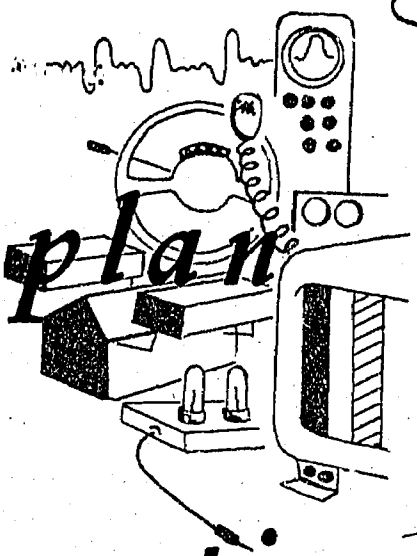
ABSTRACT

These materials inform school administrators of the rationale of the Detroit Galaxy Plan and provide procedures for implementing the Plan. This program of occupational education for secondary Grades 7 through 12 is planned for students who intend to enter college, apprenticeships, or employment after high school. The Plan, developed by 24 experienced teachers who participated in a related fellowship program, involves laboratory programs in four major career clusters: (1) Industrial Materials and Processes, (2) Energy and Propulsion Systems, (3) Visual Communications, and (4) Personal Services. "Organizational Plan" gives the rationale, summarizes the Plan, and lists the career clusters. "Instructional Content" provides exemplary objectives, lesson plans, and unit outlines. "Instruments for Evaluation" gives an instructional material evaluation guide and a student safety test. "Facilities" provides laboratory floor plans and equipment lists. A bibliography lists teaching aids, films, and books. Also included are a list of the fellows. A related document is VT 008 186. (EM)





the galaxy plan

in

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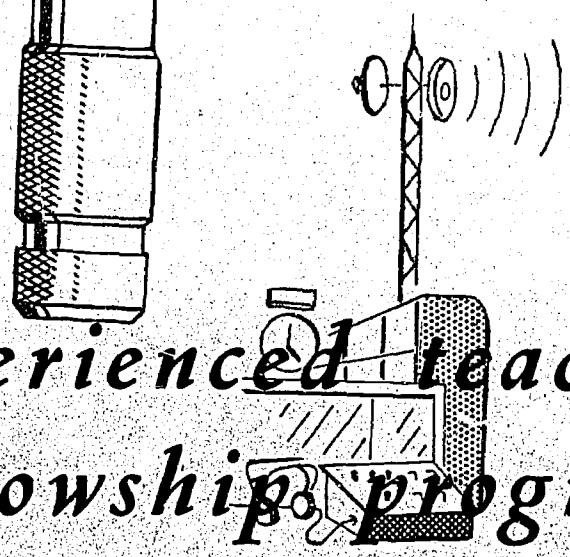

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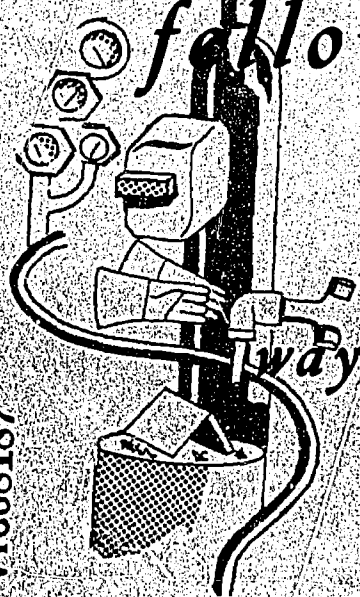

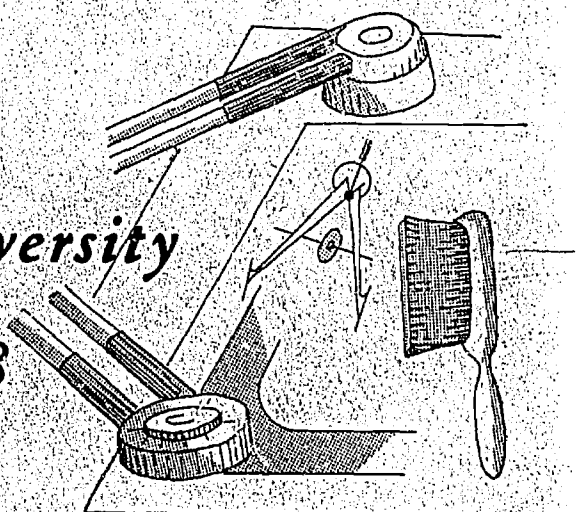

wayne state university

1967-1968

THE GALAXY PLAN IN INDUSTRIAL EDUCATION

Experienced Teacher
Fellowship Program
September, 1967 - June, 1968

Developed in the
Experienced Teacher Fellowship Program
under Title V of the Higher Education
Act of 1965, in cooperation with the
U.S. Office of Education.

Kenneth R. McLea,
Robert Aronson, and
Carl W. Butler,
Experienced Teacher Fellows

G. Harold Silvius
Project Director

Wayne State University
July, 1968

Department of
Industrial Education
Wayne State University
Detroit, Michigan 48228

WAYNE STATE UNIVERSITY

THE GALAXY PLAN

IN

INDUSTRIAL EDUCATION

1967 - 1968

by

Experienced Teacher Fellowship Program

Publishing and Editing Committee

Kenneth R. McLea, Chairman
Robert Aronson
Carl W. Butler

FOREWORD

The Detroit Galaxy Plan is one of several new curriculum approaches advocated for Industrial Education. This brochure was written to inform school administrators of the rationale of the Galaxy Plan as it supports the "World of Work" concept, and the procedures for implementing the Plan.

Two of the four clusters of the Galaxy Plan, Energy and Propulsion Systems and Industrial Materials and Processes, have been refined, developed, and field-tested by twenty-four participants of the Experienced Teacher Fellowship Program sponsored by the United States Office of Education and Wayne State University during 1967-68.

These experienced teachers received advanced technical preparation and professional courses so as to become more competent to teach in a particular cluster. Field-testing and evaluation of sample units through micro-teaching and classroom situations equipped each teacher with a nucleus of tested materials, and provided experiences in developing the techniques of planning, integrating, and evaluating such units.

The materials contained in this brochure are the product of these twenty-four experienced teachers, and represent their insights and experiences.

It is hoped that their ideas will be found useful in improving the Industrial Education program in your school.

William Wolansky

William D. Wolansky
Associate Director
Experienced Teacher Fellowship Program
Department of Industrial Education
Wayne State University

PREFACE

THE GALAXY PLAN IN INDUSTRIAL EDUCATION

The Galaxy Plan is a broad-base approach for occupational education for grades seven through twelve in secondary schools. This type of program is planned so that it would be meaningful and beneficial for youths (1) going on to colleges to prepare for the professions in such areas as science, engineering, and industrial education; (2) going to a community college or technical institute to prepare as technicians; (3) entering an apprenticeship in the building trades or manufacturing industries; or (4) developing salable skills for entering the labor force directly from high school.

During the 1967-68 academic year at Wayne State University, twenty-four Fellows, representing the length and breadth of the United States, were brought together in Detroit to study and to experiment within the Galaxy Approach to industrial arts education. The purpose of this graduate program, leading to a master's degree, was to identify patterns of content, develop and field test instructional materials, and assist these selected teachers in developing technical and professional competence to organize instruction for, and to teach in, a broad-base approach to occupational education.

The Fellows have spent the past year in graduate courses at the University, attending industrial schools, and in developing and experimenting with the Galaxy Approach for occupational education in the Detroit Public Schools. During the year it has become apparent that industrial arts education could make a significant contribution to this broad-base approach to occupational education and keep abreast of economic, scientific, and technological changes taking place in the industrial world

of work. Equally important is that industrial arts education adapt itself to the needs of youth in a technological society.

The Galaxy Plan currently being promulgated by the Detroit Public Schools provides for laboratories in four major career clusters. They are: (1) Industrial Materials and Processes; (2) Energy and Propulsion Systems; (3) Visual Communications; and (4) Personal Services. Each of these clusters organized from typical entries from The Dictionary of Occupational Titles[1] covers a wide range of careers for those (a) going into management and engineering, (b) planning to qualify as technicians, (c) hoping to enter an apprenticeship or, (d) developing a salable skill to go directly into the labor force. The program at Wayne State University for industrial arts teachers has focused on two of these occupational clusters, namely: (a) Industrial Materials and Processes and (b) Energy and Propulsion Systems. The job cluster in Industrial Materials and Processes (shown as Table 1 on Page vi) includes the study of metals, wood products, ceramics, and plastics. The occupational education cluster in Energy and Propulsion Systems (shown as Table 1A on Page vii) includes the study of electricity/electronics, power plants, instrumentation, and land, sea, and air propulsion systems.

It is suggested that this approach to occupational education be introduced by industrial arts teachers on an exploratory basis, in the 7th grade and expand into specialty concentrations by the 11th grade (as illustrated in Table 2 on Page viii). The work at WSU has been predicated

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[1]U. S. Department of Labor, The Dictionary of Occupational Titles, 2 vols., 3rd ed., 1965.

on the principle that students will have a wide spectrum of career objectives and should, therefore, study in a multiple activity program. As the student progresses, his objectives become more specific and hence, are directed into a meaningful occupational orientation.

This material in this report has been developed to help and to encourage industrial education teachers put into practice, a program that will help students take their place in the world of work.

by G. Harold Silvius

Dr. G. Harold Silvius, Professor and Chairman,
Department of Industrial Education at WSU,
Detroit, Michigan 48202 and Director of the
Experienced Teacher Fellowship Program.

and Kenneth R. McLea

Kenneth R. McLea, Teacher of Industrial Arts,
Mission High School, San Francisco, California
94114 and one of the Fellows in the 1967-68
Experienced Teacher Fellowship Program at WSU.

DETROIT PUBLIC SCHOOLS
OFFICE FOR IMPROVEMENT OF INSTRUCTION
WORLD OF WORK DEPARTMENT - VOCATIONAL EDUCATION SECTION

TABLE 1

CAREER PREPARATION
AN EXPLORATORY ANALYSIS OF VOCATIONAL EDUCATION SUBJECT AREA GALAXIES
SHOWING INSTRUCTIONAL AREAS IN DEPTH FOR FOUR LEARNER ABILITY/INTEREST AREAS

All Students (Exploratory) Grade 10		Science Engineering Further Education Essential Grades 11-12, CO-OP		Technician Further Education Recommended Grades 11-14, CO-OP		Pre-Trade Preparation Further Education Valuable Grades 10-12, CO-OP		Occupational Prep. Further Education Opt. Grades 10-11-12 CO-OP & Work Exp.	
		Note: The job titles and DOT numbers are representative examples only							
MATERIALS AND PROCESSES	1	Cybernetics	007.168 012.168 020.088	Machine Tool Layout Tape Control Technician Automation Tech. Data Process"	606.150 012.288 638.281 020.088	Machinist Tool-Die Maker Machine Repair Machine Tool Set-up	600.280 601.280 632.281 600.380	Machine Operator Press Operator Rigger Millwright	600.286 610.619 921.887 638.281
	2	Metallurgy and Microanalysis	011.081 010.081 024.081	Fabrication Technician Metallurgy Technician	619.380 011.281	Pattern Maker Welder Sheet Metal Pipe Fitter	693.281 810.884 804.281 862.381	Assemblers Production Welder Metal Finisher Burner	806.781 813.885 705.884 816.782
	3	Structures	005.081 007.081 019.081	Inspector Wood Products Technician Concrete Tech.	182.287 040.081 570.532	Lather Carpenter Model Maker Roofer Furniture Upholsterer	842.781 860.281 661.281 804.281 780.884	Millman Construction Laborer Carpenter's Helper	669.380 809.887 869.884
	4	Landscape Architecture	001.081 018.168 040.081 059.086	Nurseryman Landscape Technician Planner Park Foreman	406.168 168.168 199.168 407.134	Vegetable Grower Lawn-Shrubbery Landscape Gardener Nursery Man	403.181 406.887 407.181 406.168	Farm Hand Laborer, Nursery Garden Equipment Operator Flower Grower	421.883 406.884 409.883 406.181
	5	Industrial Chemical Applications	022.081 006.081 010.081	Ceramics Foreman Plastics Foreman Prototype Foreman	775.131 556.130 754.137	Cement Worker Bricklayer Layout Man Plasterer	844.884 861.131 751.381 842.381	Chemical Process Operator Plastics Repairman Machine Operator (Plastics) Batch Still Oper.	559.380 754.884 559.782 552.782

TABLE 1A

All Students (Exploratory) Grade 10		Science Engineering Further Education Essential Grades 11-12, CO-OP	Technician Further Education Recommended Grades 11-14, CO-OP	Pre-Trade Preparation Further Education Valuable Grades 10-12, CO-OP	Occupational Prep. Further Education Opt. Grades 10-11-12 CO-OP & Work Exp.
		Note: The job titles and DOT numbers are representative examples only			
ENERGY AND PROPULSION	1	Ground and Water Systems 014.081 Power Systems 015.197 187.198	Automotive Technician 620.131 Automobile Service Tech. 620.281 Marine Tech. 623.131	Locomotive Engineer 910.383 Auto.Mechanic 620.131 Auto Body Repairman 807.381 Outboard Engine Serviceman 625.281	Assembler 806.887 Gas Station Operator 915.867 Vehicle Driver 913.873 Truck-Tractor Operator 892.883
	2	Aero-Space Systems 002.081 021.088 013.081 025.088	Pilot 196.168 Flight Engineer 621.281 Inspector 722.381 Meteorology Technician 025.088	Air Frame Mechanic 621.281 Power Plant Mech. 621.281 Air Traffic Controller 193.168	Assembler 806.381 Plane Washer 919.887 Counterman 289.358
	3	Instrumentation and Measurement 018.188	Instrument Technician 003.281 Instrument Foreman 710.131	Office Machine Repairman 633.281 Watch Repair 715.281 Instrument Maker 600.280 Instrument Repair 710.281	Helper 710.884 Instrument Assembler 706.884 Cleaner 919.887
	4	Energy Source System 012.081 007.081 015.081 023.081	Maintenance Mechanic 631.281 Power Plant Technician 638.281 Stationary Engineering Technician 950.131 Service Superv. 187.168	Stationary Engin. 950.782 Appliance Repairman 723.781 Refrigeration Mechanic 637.281 Air Conditioning Serviceman 637.381	Oiler 699.887 Firetender 951.885 Rigger 921.280 Furnace Repair. 869.281
	5	Electronic Systems 003.081 003.151 003.187	Electronic Technician 726.281 Electronic Systems Tech. 024.288 T.V.-Radio Technician 720.281	Electrician 821.381 Industrial Electrician 825.281 Electronic Repairman 828.281 T.V.Repairman 726.781 Radio Repairman 720.281	Meter Readers 239.588 Solderer 726.781 Frameman 822.884 Assemblers 729.884

DETROIT PUBLIC SCHOOLS
OFFICE FOR IMPROVEMENT OF INSTRUCTION
WORLD OF WORK DEPARTMENT - VOCATIONAL EDUCATION SECTION

TABLE 2

CAREER PREPARATION PLAN

GRADE	CLUSTER 1 MATERIALS & PROCESSES LABORATORY	CLUSTER 2 VISUAL COMMUNICATIONS LABORATORY	CLUSTER 3 ENERGY & PROPULSION LABORATORY	CLUSTER 4 PERSONAL SERVICES LABORATORY
	JUNIOR HIGH SCHOOL			
7B	20 WEEKS ONE PERIOD			
7A			20 WEEKS ONE PERIOD	
8B		20 WEEKS ONE PERIOD		
8A				20 WEEKS ONE PERIOD
9B	10 WEEKS ONE PERIOD		10 WEEKS ONE PERIOD	
9A		10 WEEKS ONE PERIOD		10 WEEKS ONE PERIOD
	SENIOR HIGH SCHOOL			
	STUDENT MAKES VALIDATED CHOICE OF TWO OF THE FOUR CLUSTERS			
10B	20 WEEKS, TWO PERIODS, 1ST CHOICE OF TWO CLUSTERS			
10A	20 WEEKS, TWO PERIODS, 2ND CHOICE OF TWO CLUSTERS			
11	DEPTH CAREER DEVELOPMENT IN ONE GALAXY LABORATORY 80 WEEKS			
	PROGRAM		GOAL	
12	ONE PERIOD/DAY		SCIENTIST, MANAGEMENT, ENGINEER/FURTHER EDUCATION NECESSARY	
	TWO PERIOD/DAY		TECHNICAN/FURTHER EDUCATION NECESSARY	
	THREE PERIOD/DAY		SKILLED TRADES, SERVICE, SALES/FURTHER EDUCATION VALUABLE	
	FOUR PERIOD/DAY		SINGLE OPERATION OPERATOR/WORK EXPERIENCE VALUABLE	

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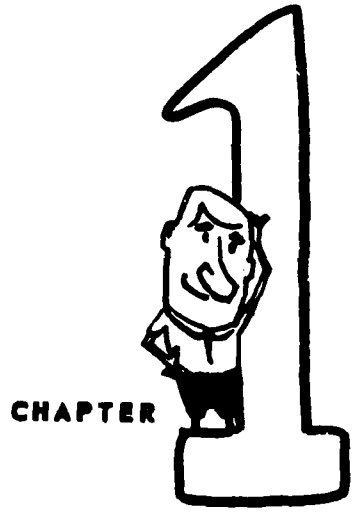

CHAPTER

ORGANIZATIONAL PLAN

Committee:

Richard F. Hornchek
Orville C. Haan
Roger A. Vicroy

CHAPTER I

ORGANIZATIONAL PLAN

The Galaxy Plan For Career Preparation

RATIONALE

We are living in an industrialized world of work, at a time when occupational change is occurring at a rapid pace. New industries seem to spring up overnight, while others become obsolete. Associated with this industrial transformation, is an unprecedented search by business and industry to seek out potential employees with an ability to adjust to these dynamic employment conditions.

The educational systems, along with other institutions, have the challenge of preparing youngsters for gainful employment. In order to meet the needs of our society in this space age, education must also undergo planned change.

The Galaxy Plan for Career Preparation is a proposal by educators to help provide controlled experiences with a core of skills related to a cluster of occupations, rather than to one distinct specialization.

Many of the former types of entry level occupations sought by students, are no longer available to graduates upon entering the labor market today. They also will find their first job can no longer be viewed as a final career commitment, but in reality it will be the first of a series of job changes hopefully leading to a satisfying career.

Young people seeking a job today are required as employees to have a broad base of cognitive, communicative and social skills. The Galaxy Plan and its cluster approach will prepare the student with these required skills and allow for steady lateral movement within a comprehensive cluster of technologies.

THE PLAN

The Galaxy Plan for Career Preparation is concerned with a broad approach to occupational education. It is organized around four groupings of technologies which serve as a basis for families of occupations stemming from a technology or combination of technologies. These groups or clusters are identified as the Materials and Processes Cluster, the Energy and Propulsion Cluster, the Communication Cluster and the Personal Services Cluster. Using the cluster method of curriculum organization for occupational preparation, we should find that the necessary content will change less than previous curricula when it is related to the broad aspect of our overlapping technologies.

The Galaxy Plan must involve all the departments in the secondary schools that now are preparing students for the entry level occupation. The business education, distributive education, home economics, industrial arts and vocational education departments are examples of our secondary curricula that will have to work closely together. Cooperation between all other departments and professional services found within the school will, also, be needed to help carry out this career preparation plan.

The students' first experiences under the Plan with the "world of work" will occur during the seventh and eighth grades. Equal time will

be devoted by every student to each of the four clusters during these two years. The experiences within the four clusters will provide the students with a sound foundation on which to build his or her future career plans. Four appropriate activity rooms or laboratories must be provided to allow every student to explore the technologies of each cluster by using the project and creative investigation methods. These exploratory activities must be broad, enabling each child to discover a cluster challenging to him or her.

At the ninth grade level, every student will once again experience the four clusters through a ten week rotational plan. A major purpose of this final broad exposure, is to enable the student to make a wise choice of his or her planned high school curriculum. The student, before leaving the junior high school, will make a choice of two clusters most related to his or her personal interests and identified talents. The exercise method should be used at this level so the student can measure his or her tolerance of the disciplines necessary in each of the career preparation programs. By now the student will also have some manipulative knowledge in each of the four clusters.

The two clusters chosen by the student will be further explored at the tenth grade level. During this year the student will be required to decide on one cluster for in-depth career preparation during the eleventh and twelfth grade levels. This decision must be made only after careful advisement, utilization of all the school's guidance services and with the cooperation of the parents.

During the final two years of high school the student will be able to

specialize within the cluster of his choice. In addition to the chosen specialization, the school must provide a flexible or modular schedule so the degree of career preparation can be modified or tailored to the ability level of the student. Some students will become involved in cooperative work experience programs, which will possibly take as many as five periods out of the school day. Others will be preparing for college and possibly as little as one period per day or even per week will be devoted to the career preparation laboratory. The important point is that during the last two years, the career preparation programs must be tailored to the individuals needs and every student will still be allowed to elect a laboratory experience throughout his secondary education.

FAMILIES OF TECHNOLOGIES

RELATED TO CLUSTERS

MATERIALS AND PROCESSES

Metals
Plastics
Woods
Ceramics
Glass
Textiles

Machining
Welding
Forming
Fabrication
Foundry
Metallurgy
Coatings
Forging
Automation

ENERGY AND PROPULSION

Engines & Motors
Electricity & Electronics
Atomic Energy & Fuel Cells
Fluid Power

Application
Servicing
Operation
Installation
Transmission
Instrumentation

PERSONAL SERVICES

Food
Clothing
Shelter
Recreation
Entertainment
Health & Beauty

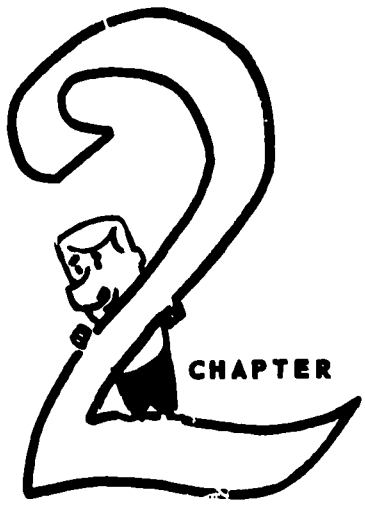
Preparation
Maintenance
Repair
Sales
Protection
Distribution

VISUAL COMMUNICATIONS

Publishing
Advertising
Commerce

Clerical
Printing
Photography
Drafting
Writing
Reporting
Design

CHAPTER 2



INSTRUCTIONAL CONTENT

Committee:

ENERGY AND PROPULSION

Robert Aronson, Chairman
Victor Bridges
Carl W. Butler

MATERIALS AND PROCESSES

William H. Carson, Chairman
Terry L. Davis
Edwin A. Gray

INTRODUCTION

Energy and Propulsion

One of the goals of education is to prepare people for gainful employment. Fortunately many of the manipulative skills and knowledge skills in one area are often transferable to other job classifications. This is the basic principle behind a cluster of occupations rather than a specific trade or job area. This cluster is structured toward energy and propulsion and is designed to develop interest in land vehicles, sea vehicles, air vechicles, power plants, instrumentation, electricity and electronics.

Materials and Processes

It would seem appropriate to utilize team teaching techniques as a means of involving the student in a variety of laboratory activities designed to accomplish the objectives of Materials and Processes. Team teaching would simplify the problem of organization, and provide an effective means for involving the student in the interrelated use of materials in a single product. Some products and construction activities may only involve the use of a single material, but to be more representative of industry and the Materials and Processes concepts, a variety of materials should be considered in relation to production associated with industry.

Whether team teaching is practical or not will depend on the school's philosophy. However, the objectives cannot be realized to the degree considered desirable in a traditional teaching-learning situation. In

order to bring about a greater understanding of our industrial society and to reach the desired objectives, students should become involved in activities centered around the management and production systems. To attain the objectives for the cluster of Industrial Materials and Processes, students should study the various functions of a typical industry, organize, and mass produce a product involving the use of several materials and many processes. The laboratory experiences must reflect our industrial society and prepare youth to think and solve problems associated with salable employment in the world of work.

CHAPTER II

INSTRUCTIONAL CONTENT

Goals of the Galaxy Approach in Industrial Education

1. To provide a curriculum to meet the needs of students with varying abilities, aptitudes, desires, and interests.
2. To cluster information and experiences relevant to related occupations.
3. To discover and encourage the occupational talents and abilities of students which are consistent with their interests.
4. To develop desirable habits, traits, and attitudes relative to the world of work.
5. To provide generous experience in each cluster to aid pupils in the selection of an occupation and develop skills pertinent to creative leisure.
6. To be able to identify and effectively use tools and equipment associated with the occupational clusters.
7. To develop an understanding of the relationship of each cluster to our industrial society.

Specific Objectives of the Materials and Processes Cluster of the Galaxy Approach to Industrial Education

1. To be able to identify various materials and select an appropriate material for a particular application.
2. To be able to identify and use machines and tools to form materials into useful products.
3. To identify the nature and status of industry in our society.
4. To be able to intelligently identify quality and design features as a consumer of industrial products.
5. To identify the role of industrial organization and planning for effective production.
6. To develop a desirable work attitude and promote an interest in productive work in the industrial complex.

Specific Objectives of the Energy and Propulsion Cluster of the Galaxy Approach to Industrial Education

1. To know the nature of energy in its various forms and its role in modern society.
2. To know the principles of operation on engines and their application.
3. To know the principles of electricity and electronics and their applications.
4. To develop skills in the use of instrumentation and the art of mensuration.
5. To provide opportunities for experiences in the field of Energy and Propulsion Systems.
6. To develop desirable work habits and attitudes for productive work in our industrial complex.

UNIT OUTLINE

I. Title: Energy and Propulsion

II. Unit Title: Fluid Power Fundamentals

III. Objectives:
- A. The student will be able to identify the common components of an hydraulic circuit.
- B. The student will be able to explain the function of each hydraulic component.
- C. The student will be able to "plumb" up a typical hydraulic circuit on the lab bench.
- D. Through visitations of local industries, the student will be able to identify several of the most important uses of fluid power in our economy.
- E. The student will become proficient in the use of tools used in fluid power.

IV. Outline of Unit Content
- A. There will be a presentation, discussion and review of the fundamentals of fluid power.
- B. A presentation and discussion of simple fluid power components as they are used in the typical circuits.
- C. A demonstration will be given using the various components and visual aids that are available for the course.
- D. The many simple hand tools necessary for the lab work will be presented and discussion of their use and safety will follow.
- E. The materials and resources necessary for the presentation are:
  1. Transparencies
  2. Cut-aways
  3. Movies
  4. Film strips
  5. Components of hydraulic circuits
  6. Fluid power bench
  7. Basic hand tools
- F. An evaluation of each session will be obtained by open questions and written tests or job sheets.

V. Suggested Activities
   A. Students will "plumb" circuits of typical design on the lab benches.

   B. Students will diagnose and repair "troubles" in fluid power circuits.

   C. Students will disassemble and reassemble components of fluid power circuits such as:

      1. Power steering pumps
      2. Hydraulic brakes
      3. Hydraulic jacks
      4. Components of fluid power circuits
      5. Air wrenches
      6. Air lifts
      7. Presses

   D. Field trips will be organized to visit local industries and construction companies that use fluid power machinery extensively.

   E. An invitation will be extended to an instructor of fluid power in a local college to present a short session about their program.

VI. Textbooks and Resource Materials

   A. Class textbook for fundamentals of fluid power
      1. Bureau of Naval Personnel, Fluid Power, Navy Training Course, NAVPERS 16193-A.

      2. Pease, Dudley, Basic Fluid Power, (New York, New York: Prentice-Hall, Inc., 1967).

   B. Resource materials
      1. Cut-aways of hydraulic components
      2. Cardboard slide rules from:

         Flick-Reedy Corporation
         Miller Products
         7N015 York Road
         Bensenville, Illinois 50106 (free)

      3. Hydraulic components drawing template from:

         Racine Hydraulics and Machinery
         Racine, Wisconsin (free)

      4. Movies and slides

         Double A Products
         Manchester, Michigan 48158

         Parker-Hannifin Corporation
         17325 Euclid Avenue
         Cleveland, Ohio 44112

Vickers, Inc.
P. O. Box 302
Troy, Michigan 48084

VII. Evaluation materials

A. Written tests and quizzes

1. Tests will be given at the end of each session and will be of the true and false, multiple-choice, and word completion type.
2. Class participation will be evaluated as part of the final grade. Oral questions and class discussion will generate class involvement.

B. Lab work evaluation

1. Job work sheets will be used as an aid by students to help them to learn the circuits and components.
2. A chart will be posted listing the students names and all the required jobs. Each will be checked as they are completed.
3. Notebooks will be used by each student for reference in class and lab. They will be filled out each day and used as a partial evaluation instrument.

LESSON PLAN

METHOD OF INSTRUCTION	TITLE OF CLUSTER	LESSON NUMBER
Lecture	Energy and Propulsion	1

UNIT TITLE

Hydraulics

TOPIC

Introduction to Pascal's Law

OBJECTIVES

1. To define Pascal's Law in simple terms.
2. To indicate, by drawing arrows, the direction of forces acting on a confined fluid given a drawing.

TOOLS, EQUIPMENT, AND MATERIALS

1. Transparencies
2. Chalk board

TEACHING AIDS AND DEVICES

Screen
Overhead projector
Overhead Transparency

TECHNIQUES

Refer to the diagram on the transparency as a means of illustrating Pascal's Law.

ASSIGNMENTS

Text: Pages 1 - 3

PROCEDURE

1. Greeting
2. Introduce topic
3. Purpose of topic
4. Statement of objectives
5. Explanation of topic and interaction of students
6. Question review
7. Closure

REFERENCES

Pease, Dudley A., Basic Fluid Power, (New York: Prentice-Hall, Inc.), 1967.

UNIT OUTLINE

I. Title: Materials and Processes

II. Unit Title: "The Old and The New of Foundry Work"

III. Objectives:
- A. To learn to identify by name and function the tools, equipment, and operations basic to foundry practice.
- B. To compare wood pattern casting, wax pattern casting, and styrofoam casting.
- C. To determine the advantages and disadvantage of each method in relation to the item being cast.

IV. Outline of Unit Content
- A. Lesson I: Introduction. "What is foundry work?"
  1. Terminology
  2. Equipment
  3. Tools
  4. Materials
  5. Safety practice
- B. Lesson II: Casting with a wood pattern
- C. Lesson III: Casting with the "lost wax" pattern
- D. Lesson IV: Casting with a styrofoam pattern

V. Suggested Activities
- A. Teacher demonstrations with maximum student participation.
- B. Select students to make a wax and styrofoam pattern.
- C. Follow-up with student projects.

VI. Textbook and Resource Materials
- A. Textbook
  1. Ludwig, Oswald, Metal Work Technology and Practice, (Bloomington, Illinois: McKnight & McKnight Publishing Company), 1962.
- B. Resource materials
  1. Feirer, John L., General Metals, (New York: McGraw-Hill Book Company), 1959.
  2. Lindberg, Roy A. Processes and Materials of Manufacture, (Boston, Mass.: Allyn and Bacon, Inc.), 1964.
  3. Miner, Harvey D., Exploring Patternmaking and Foundry, (Princeton, New Jersey: D. Van Nostrand Co., Inc.) 1959.

VII. Evaluation Materials
A. Test: Final test on the four lessons
1. Type: Take home: objective and short answer
2. Purposes
a) Student evaluation
b) Evaluation of material presented

LESSON PLAN

METHOD OF INSTRUCTION	TITLE OF CLUSTER	LESSON NUMBER
Demonstration	Materials and Processes	4

UNIT TITLE

"The Old and The New of Foundry Work"

TOPIC

Casting with a Styrofoam Pattern

OBJECTIVES

1. To learn to make a styrofoam pattern.
2. To learn to cast from a styrofoam pattern.

TOOLS, EQUIPMENT, AND MATERIALS

1. Standard foundry tools
2. Large piece of casting styrofoam
3. Old knife for heat cutting
4. Flame heat source
5. Sandpaper and sanding block
6. Styrofoam drinking cup
7. Aluminum foil
8. Elmer's glue
9. Styrofoam heat cutter (if available)
10. Band saw (if available)

TEACHING AIDS AND DEVICES

A completed styrofoam pattern
A completed pattern with styrofoam gates, sprue, & pour cup
A completed raw casting
Handout: "Procedure and Making a Styrofoam Pattern and Casting"

PROCEDURE

1. Introduction: Relationship of styrofoam casting to investment and solid pattern casting.
2. Procedure for making the pattern.
3. Assembly of the pattern to the gates, sprue, and pouring cup.
4. Ramming of a styrofoam pattern.
5. Special safety precautions of styrofoam casting.
6. Pouring of the casting.

TECHNIQUES

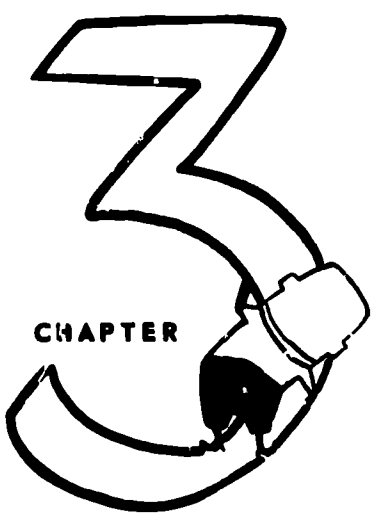
Teacher guided demonstration. Select a student assistant to give the actual manipulative demonstration following your explanations.

ASSIGNMENTS

Read the handout: "Procedure for Making a Styrofoam Pattern and Casting"

REFERENCES

Swanson, Robert S., Plastics Technology (Bloomington) 1965, pp. 95 - 97 & 177 - 183.


CHAPTER

INSTRUMENTS FOR EVALUATION

Committee:

William W. Davison, Chairman
Eugene J. Kirby
Edward R. Lee
Luther E. Saunders

INTRODUCTION

This chapter is devoted to Instruments for Evaluation. It consists of a series of tests and check sheets concerning the two Galaxies of Energy and Propulsion, and Materials and Processes. These are designed to help the teacher in selecting materials for instruction and as a reference for test samples involving fluid power, automotive mechanics, electricity, metalworking, woodworking, and plastics.

CHAPTER III

INSTRUMENTS FOR EVALUATION

Material Evaluation Guide

This evaluation guide is designed to be used by the teacher to assist him to get the most effective use of instructional materials.

Instructor_____ Subject_____ Date_____

	low high
(not applicable)	na 1 2 3 4 5 (circle one)

Organization

1. The class level was considered when selecting contents of material.	na 1 2 3 4 5
2. Clarity of objectives (purpose of lesson clear).	na 1 2 3 4 5
3. The individual parts of the lesson materials are clearly related to each other.	na 1 2 3 4 5
4. The material contributed an interesting and meaningful understanding of the lesson content.	na 1 2 3 4 5
5. The most effective material available was used.	na 1 2 3 4 5

Use of Materials

1. The information needed was available in the following media: (circle answer)

Transparencies	yes	no	Programmed Materials	yes	no
Motion Pictures	yes	no	Charts	yes	no
Film Strips	yes	no	Periodicals	yes	no
Slides	yes	no	Recordings	yes	no

2.	Are other reference materials available in the classroom?	yes no
3.	Is this material available to other classes in the system?	yes no

Quality of Audio and/or Visual Materials

1.	Are contents in harmony with technological advancements and terminology?	na 1 2 3 4 5
2.	Is the subject matter accurate?	na 1 2 3 4 5
3.	Is the content of the material in proportion to the length of the instructional time allocated?	na 1 2 3 4 5
4.	If the aid is one of a commercial nature, is the degree of advertising kept to a minimum?	na 1 2 3 4 5
5.	Is it interesting to the student?	na 1 2 3 4 5
6.	Are diagrams or charts clear and arranged for optimum instructional purposes?	na 1 2 3 4 5
7.	Are titles, print, and notes large enough and arranged effectively so as to be easily read within the time available?	na 1 2 3 4 5
8.	Are the visual materials attractive and in good condition?	na 1 2 3 4 5
9.	Is the narrator's voice clear and easily understandable?	na 1 2 3 4 5
10.	Sound effects (if any) are clear, sharp and representative of actual production.	na 1 2 3 4 5
11.	Bulletin boards are attractive and kept up to date.	na 1 2 3 4 5

Tools and Equipment

1.	Tools and equipment in good working order and is readily available for use in the class.	na 1 2 3 4 5
2.	Safety precautions are posted clearly on machines.	na 1 2 3 4 5

3. Tools and equipment are attractively displayed and located so they can be found, used and replaced without difficulty. na 1 2 3 4 5

4. Sufficient equipment and material is available for class to participate in class activity. na 1 2 3 4 5

Comments:

Evaluated by _____

Fluid Power Safety Questions

True-False (circle the correct answer)

T F 1. A machine operator should understand the function and operating principle of all the component parts of the machine.

T F 2. To safely operate a machine, one should understand the function and operation of the machine's control system.

T F 3. Loose fitting and comfortable clothing is necessary for the machine operator.

T F 4. When working with equipment using fluid power systems it is not necessary to wear safety glasses because of the fluid.

T F 5. Hasty emergency repairs many endanger life or damage the equipment.

T F 6. Preventive maintenance is costly and generally speaking it is seldom practiced in industrial applications.

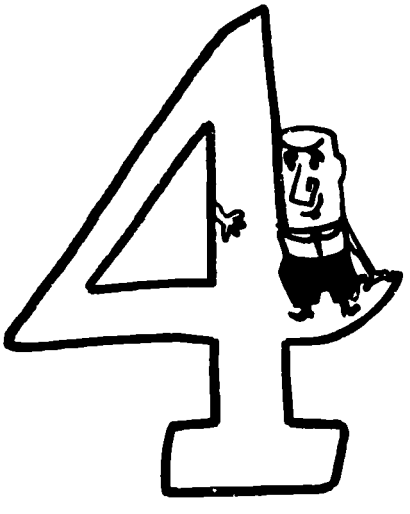
T F 7. Contribute information to the safety and well-being of others.

T F 8. Hydraulic shock and damage to costly hydraulic components can be a result of operation of controls in a reckless manner.

T F 9. If the machine is equipped with an accumulator, be sure its pressure energy is released when preparing for shutdowns.

T F 10. A good method to temporarily stop a "pinhole" leak in a hydraulic circuit is to apply pressure over it with your finger. This is sometimes necessary to stop the leak while someone gets some plastic tape to permanently repair it.

CHAPTER 4



FACILITIES

Committee:

ENERGY AND PROPULSION

John P. Novosad, Chairman
Lester Paige

MATERIALS AND PROCESSES

Orin L. Buchleither, Chairman
Edwin L. Munford

CHAPTER IV

FACILITIES

Introduction to Facilities

This chapter suggests ideal plans for Energy and Propulsion, and Materials and Processes laboratories. Both floor plans are designed for ninth and tenth grade level students. The Communications and the Personal Services Galaxies of the total Galaxy Plan have not been considered at this time, but it is imperative that all four Galaxies be considered in planning the total ideal facility.

The facilities for the Galaxy Plan can be adapted to the existing industrial education structure in a school. These ideal laboratories are designed to accommodate twenty-four students per teacher.

Each plan takes into consideration the maximum utilization of space by sharing equipment which may be common to various technologies within each Galaxy. The Materials and Processes facility is designed for study in materials testing, industrial woods, metals, plastics, and ceramics. The Energy and Propulsion plan includes facilities for engines, fluid power (hydraulics and pneumatics), electricity, and electronics.

All areas in each facility may be used simultaneously thus allowing for a greater variety of equipment and student experiences.

MATERIALS AND PROCESSES LABORATORY EQUIPMENT GUIDE

CLASSROOM

1. 5-wheel polishing bench
2. Bakelite mounting press
3. Porcelain sink
4. Brinell hardness tester
5. Rockwell hardness tester
6. Tensile tester
7. Metallurgical microscope
8. Book shelves
9. Drafting tables
10. Student desks
11. Glass front display case
12. Portable projector set
13. Pull-down screen
14. Overhead projector
15. Demonstration bench
16. Teacher's desk
17. Chalk board
18. Display board
19. File

INDUSTRIAL WOODS

20. Radial arm saw
21. Table saw
22. Jointer
23. Band saw
24. Scroll saw
25. Pedestal grinder
26. Drill press
27. Tool storage
28. Spindle shaper
29. Disc sander
30. Woodworking benches
31. Planer
32. Glue table
33. Dust collector
34. Wood lathe

INDUSTRIAL PLASTICS

35. Extruding machine
36. Injection molder
37. Strip heater
38. Plastic heating oven
39. Refrigerator
40. Pressure, vacuum, & mech. forming machine
41. Buffer

INDUSTRIAL CERAMICS

42. Ceramic kiln
43. Wedging board
44. Potter's wheel
45. Clay cabinet

INDUSTRIAL METALS

46. Stake plate bench
47. Slip roll
48. Box and pan brake
49. Metal top bench
50. Squaring shears
51. Revolving machine stand
52. Bar folder
53. Bar and angle iron bender
54. Gas welding unit, port.
55. Gas welding unit, stat.
56. Spot welder
57. D. C. arc welder
58. Welding booth
59. A. C. arc welder
60. Flexible shaft machine, portable, ½ hp
61. Ventilation hood
62. Crucible furnace
63. Heat-treating furnace
64. Furnace forge
65. Molding bench
66. Soldering bench
67. Hydraulic bench
68. Metal buffer
69. Radial drill machine
70. 20" drill press
71. Metal cutting band saw
72. Belt sander
73. Power hack saw
74. Vertical milling machine
75. Horizontal milling mach.
76. Surface grinder
77. Metal shaper
78. 10" machine lathe
79. 14" machine lathe
80. Portable band saw
81. Arbor press
82. Bench grinder
83. Machinists bench
84. Machinists bench, vises
85. Metal spinning lathe
86. Surface plate
87. Dust collector

FINISHING ROOM

88. Paint spray booth
89. Turn-top paint bench
90. Air compressor
91. Paint storage
92. Drying racks
93. Work counter
94. Stainless steel sink

PROJECT STORAGE

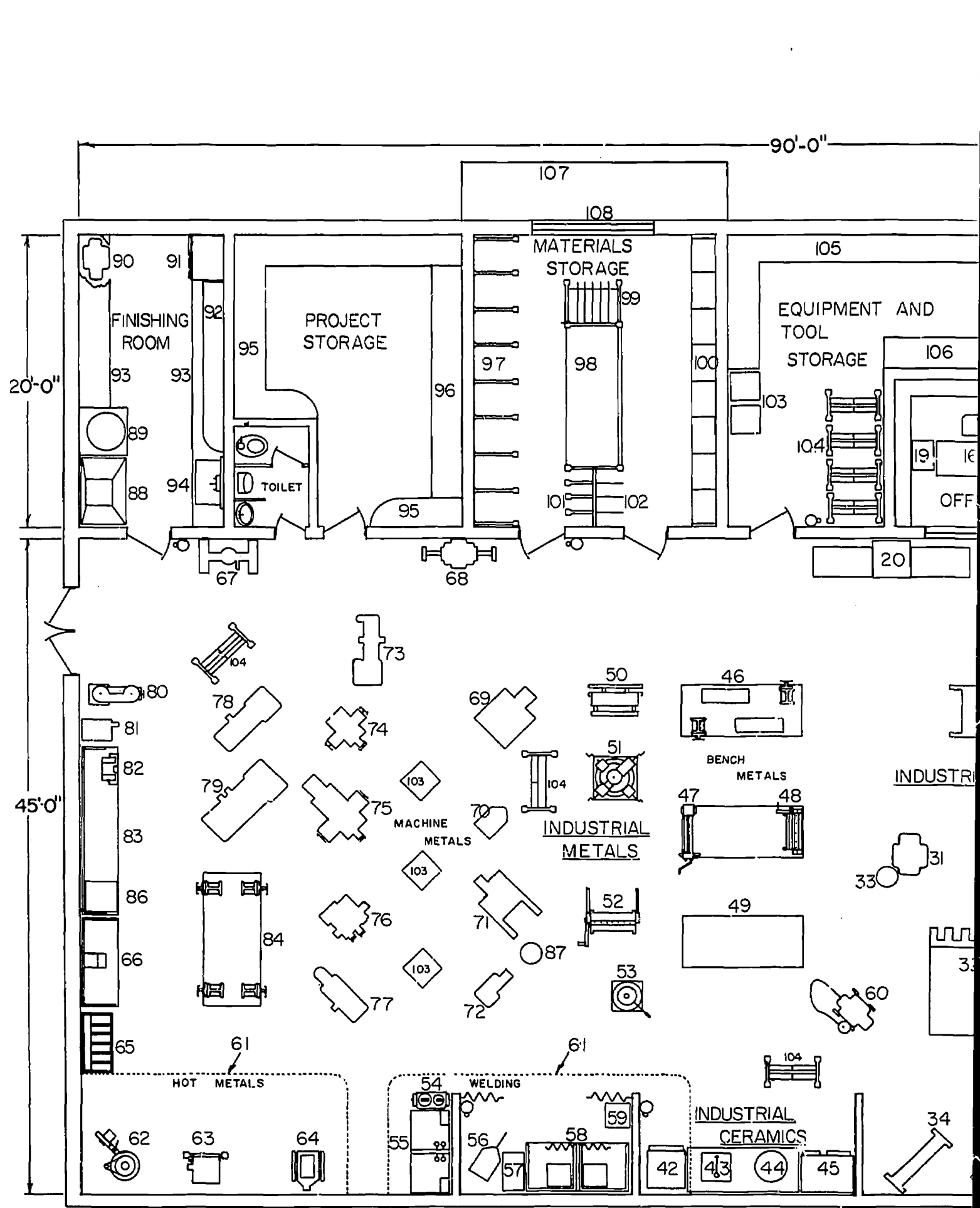
95. Open shelves
96. Student lockers

MATERIAL STORAGE

97. Horizontal lumber rack
98. Plywood stock rack
99. Sheet metal rack
100. Horizontal metal rack
101. Short stock lumber rack
102. Short stock metal rack

GENERAL ITEMS

103. Portable work benches
104. Portable tool panels
105. Storage shelves
106. Storage cabinet
107. Loading dock
108. Overhead roll-down door
109. Water cooler
110. First aid kit
111. Half-round sink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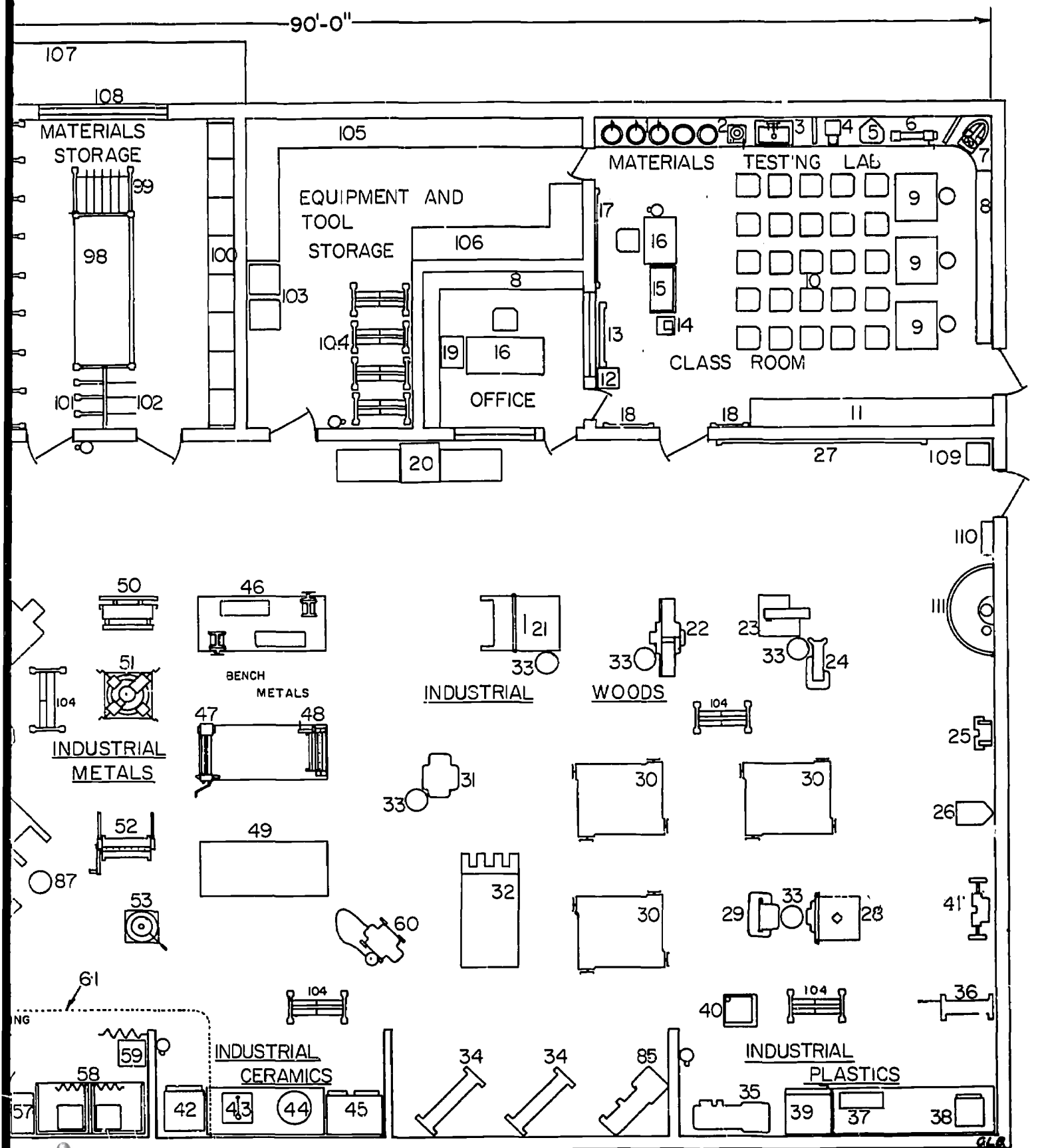
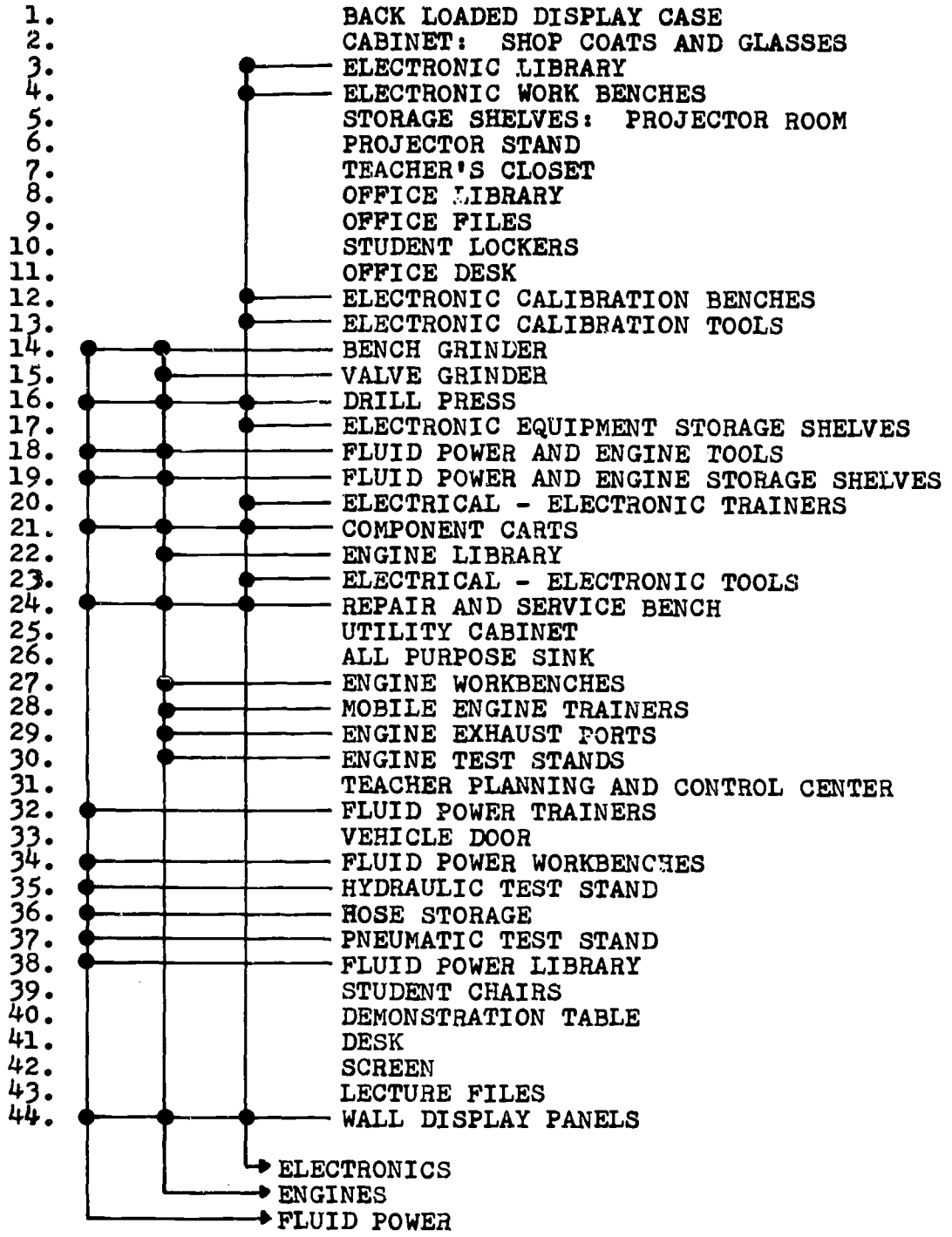
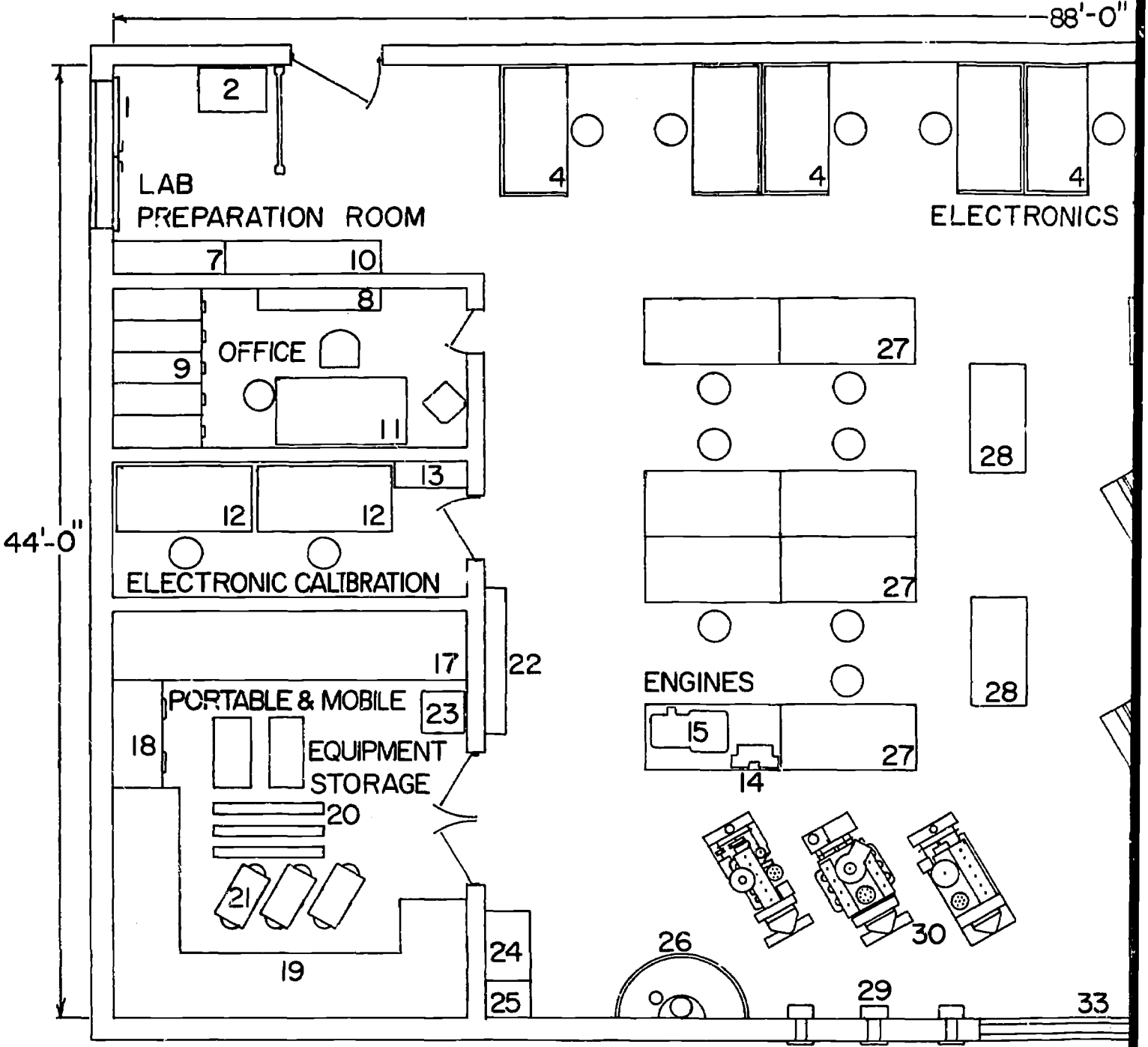
FINISHING ROOM
PROJECT STORAGE
MATERIALS STORAGE
EQUIPMENT AND TOOL STORAGE
TOILET
OFF
BENCH METALS
INDUSTRIAL METALS
MACHINE METALS
HOT METALS
WELDING
INDUSTRIAL CERAMICS
INDUSTRIAL MATERIALS AND PROCESSES LABORATORY



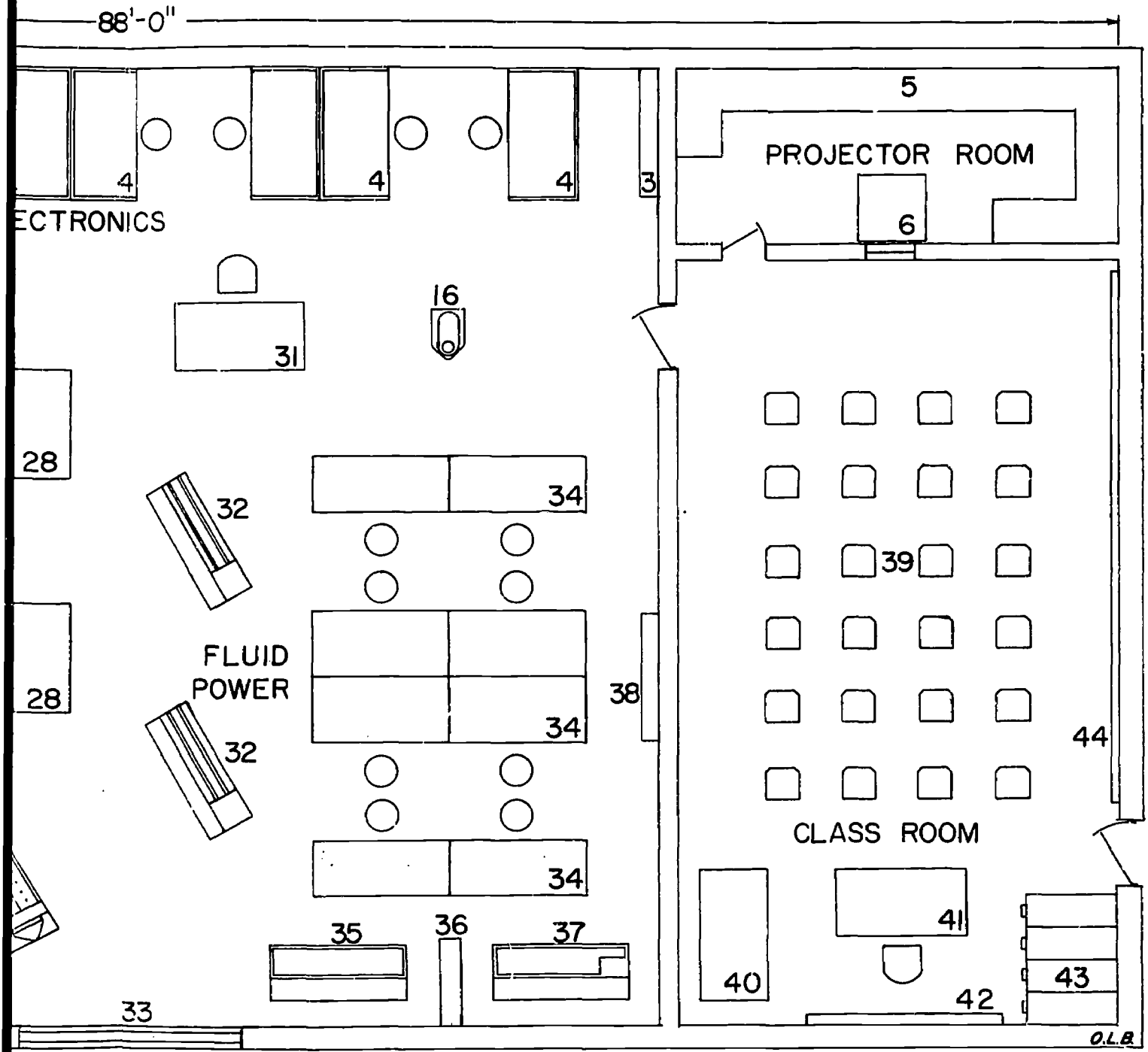
CERICES LABORATORY

EQUIPMENT


1. BACK LOADED DISPLAY CASE
2. CABINET: SHOP COATS AND GLASSES
3. ELECTRONIC LIBRARY
4. ELECTRONIC WORK BENCHES
5. STORAGE SHELVES: PROJECTOR ROOM
6. PROJECTOR STAND
7. TEACHER'S CLOSET
8. OFFICE LIBRARY
9. OFFICE FILES
10. STUDENT LOCKERS
11. OFFICE DESK
12. ELECTRONIC CALIBRATION BENCHES
13. ELECTRONIC CALIBRATION TOOLS
14. BENCH GRINDER
15. VALVE GRINDER
16. DRILL PRESS
17. ELECTRONIC EQUIPMENT STORAGE SHELVES
18. FLUID POWER AND ENGINE TOOLS
19. FLUID POWER AND ENGINE STORAGE SHELVES
20. ELECTRICAL - ELECTRONIC TRAINERS
21. COMPONENT CARTS
22. ENGINE LIBRARY
23. ELECTRICAL - ELECTRONIC TOOLS
24. REPAIR AND SERVICE BENCH
25. UTILITY CABINET
26. ALL PURPOSE SINK
27. ENGINE WORKBENCHES
28. MOBILE ENGINE TRAINERS
29. ENGINE EXHAUST PORTS
30. ENGINE TEST STANDS
31. TEACHER PLANNING AND CONTROL CENTER
32. FLUID POWER TRAINERS
33. VEHICLE DOOR
34. FLUID POWER WORKBENCHES
35. HYDRAULIC TEST STAND
36. HOSE STORAGE
37. PNEUMATIC TEST STAND
38. FLUID POWER LIBRARY
39. STUDENT CHAIRS
40. DEMONSTRATION TABLE
41. DESK
42. SCREEN
43. LECTURE FILES
44. WALL DISPLAY PANELS
ELECTRONICS
ENGINES
FLUID POWER



ENERGY AND PROPULSION LABORATORY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CLASS ROOM
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Committee:

John C. Ruppert
George T. Seriguchi
Joseph A. Wagner

BIBLIOGRAPHY

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"Practical Hydraulics". Vickers Incorporated, Division of Sperry Rand Corporation, Administrative and Engineering Center.

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"Application of Pascal's Law" Part I 15min/16mm. color. United World Films, Government Film Department.

"Automation Today" 15min/16mm. B&W. Supervisor, Training Department, Ford Motor Company.

"Basic Hydraulics" 15min/16mm. United World Films, Government Film Department.

FILM STRIPS

"Pneumatic Circuitry". Parker-Hannifin Corporation.

TRANSPARENCIES

Vega Hydraulic Power Training, Box 1006, Decatur, Illinois.

TRAINING FILM SOURCES

Film Library, Public Relations Section, General Motors Corporation

Modern Talking Pictures

School Assistance Department, Perfect Circle Corporation

Materials and Processes

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Index to 16MM Films. National Information Center for Educational Media. New York: McGraw-Hill Book Co., 1967.

United States Government Films Service. Department of Health, Education, and Welfare, U. S. Government Printing Office, 1967.

Experienced Teacher Fellowship Program

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Outline Map of the United States