

2013

ENGINEERING AND TECHNOLOGY EDUCATION

Georgia Department of Education
PROGRAM SUPPORT MATERIAL

SUGGESTED PATHWAY LAB LAYOUTS AND
EQUIPMENT LISTS: Engineering,
Engineering Graphics & Design, Energy
Systems, Electronics, Manufacturing, and
Middle School Engineering and Technology

With new facility design, engineering and technology education instructors will have the ability to apply rigorous curriculum components that assist students in developing the mental processes necessary for problem solving. These problem solving skills will enhance the students' ability to attain high-skill, high-demand, and high-wage careers.

Program Support Material

5/22/2013

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Introduction/Rationale

The goals of engineering and technology education are focused on enabling students to become more technologically literate with in-depth experiences geared to career preparation. Students develop deeper problem-solving skills leading to consumer awareness and personal enrichment as well as occupational readiness. Engineering and technology education strives to develop critical-thinking skills in such ways that students become more discriminating with regard to technology and its impact on society. Class projects are designed to expand the mental methods of inquiry that are used when solving technology problems. This goal is achieved through a combination of experiences in the engineering and technology laboratory.

Educators will increase the opportunities for student to become more technologically literate by collaborating with teachers in other disciplines. Students will be introduced to a wide variety of instructional methods that encourage them to connect their learning with real world issues and problems. Typical objectives learned in engineering laboratories are: (a) Apply appropriate instrumentation including software tools to make measurements, (b) Identify strengths and limitations of theoretical models, (c) devise an experimental approach, specifying and implementing equipment and procedures to take and interpret data to characterize engineering materials, components, or systems, (d) analyze and interpret data, (e) design, build, or assemble a part, a product, or a system, (f) identify and learn from unsuccessful outcomes, (g) demonstrate levels of independent thought, creativity, and capability in solving real world problems, (h) understand impact of engineering solutions in global and societal contexts, and (i) select, modify, and operate appropriate engineering tool, and (j) identify and deal with health, safety, and environmental issues related to technological processes.

Area	Description	Engineering and Technology Pathways					
		Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Instructional Spaces	Combination Computer, Lecture, Presentation Area	X	X	X	X	X	X
	Flexible Workspace for Project Staging, Materials Testing, Creative Problem Solving, and Team Work	X		X	X	X	X
	Prototyping/Material Processing Area	X		X	X	X	X
	CNC/CIM/Rapid Prototyping Area	X	X			X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Support Spaces	Instructor Office	X	X	X	X	X	
	General Storage/Supply Room	X	X	X	X	X	X
	Project Storage Room/Cabinets	X	X	X	X	X	X
	Equipment/Tool Storage Room	X				X	

Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Computer Lab Furniture	Bookshelf Storage Case	X	X	X	X	X	X
	Bulletin Board	X	X	X	X	X	X
	Combination CAD/Drafting Student Workstations		X				
	Computer Style Chairs	X	X	X	X	X	X
	Display Cabinet with Shelves	X	X	X	X	X	X
	File Cabinet	X	X	X	X	X	X
	Instructor Work Station/Desk	X	X	X	X	X	X
	Lockable Storage Cabinet	X	X	X	X	X	X
	Magazine Rack	X	X	X	X	X	X
	Marker Board	X	X	X	X	X	X
	Multimedia Cabinet	X	X	X	X	X	X
	Printer Table	X	X	X	X	X	X
	Projection Screen	X	X	X	X	X	X
	Student Computer Desks	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy	Electronics	Manufacturing	Middle School
Flexible Lab	Activity Storage Cabinet w/Tote Trays	X	X	X	X	X	X
	Lockable Storage/Supply Cabinets	X	X	X	X	X	X
	Mobile Material and Activity Cart	X	X	X	X	X	X
	Printer Table	X	X	X	X	X	X
	Prototype and Testing Stations on Casters with Adjustable Stool	X		X		X	

	Prototype and Testing Stations with electrical risers and Adjustable Stool				X		
	Storage Cabinet	X	X	X	X	X	X
	Teacher Command Station	X	X	X	X	X	X
	Activity Storage Cabinets w/Tote Trays	X	X	X	X	X	X
	Demonstration Table	X	X	X	X	X	X
	Lockable Storage/Supply Cabinets	X	X	X	X	X	X
	Mobile Material and Activity Cart	X	X	X	X	X	X
	Standing-Height Shop-Style Workbenches		X				X
	Storage Lockers for Projects	X	X	X	X	X	X
	Tool Storage Cabinet	X				X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Office Furniture	Book Storage Shelves	X	X	X	X	X	
	Book/Multimedia Storage Cabinet	X	X	X	X	X	
	Instructor Desk	X	X	X	X	X	
	Lockable Storage Cabinet	X	X	X	X	X	

Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Storage Space Furniture	Braced Metal Storage Shelving	X	X	X	X	X	X
	Large Clear Plastic Bins	X	X	X	X	X	X
	Lockable Storage Cabinet	X	X	X	X	X	X
	Mobile Wire Rack Storage Shelving	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Facility Safety	Clear Sightlines within Space for Student Supervision	X	X	X	X	X	X
	Emergency Shut Off Switch	X		X	X	X	X
	Evacuation Plans	X	X	X	X	X	X
	Eye Wash Station	X		X	X	X	X
	Fire Extinguishers	X	X	X	X	X	X
	Fire Resistant Trash Can	X		X	X	X	X
	Flammable Storage Cabinet (Vented)	X		X	X	X	X
	General Safety Rules Posted	X	X	X	X	X	X
	Glass Sterilizing/Storage	X	X	X	X	X	X
	Hazardous Chemical Storage Cabinet (Vented)			X	X		
	High-Impact Block Walls	X		X	X	X	X
	High-Impact Safety Glass in Divided Areas for Supervision	X	X	X	X	X	X

	Kill Switches for Large Equipment	X	X	X	X	X	X
	Machine Exhaust System	X	X	X	X	X	X
	Machine Specific Safety Rules Posted at Each Machine	X	X	X	X	X	X
	Mounted First Aid Kit	X	X	X	X	X	X
	Paper Towel Rack	X	X	X	X	X	X
	Quick Communication to Main Office	X	X	X	X	X	X
	Regulated Air Connection	X	X	X	X	X	X
	Safety Signs	X	X	X	X	X	X
	Shields/Guards on Machines	X	X	X	X	X	X
	Sink with Soap Dispenser	X	X	X	X	X	X
	VCT, or Polished Sealed Concrete in Production and Storage Areas to Minimize Trip Hazards	X		X	X	X	X
	Well Marked Safety Zone Areas	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Personal Safety	Dust Masks	X		X	X	X	X
	Ear Protection	X	X	X	X	X	X
	Eye Protection (Safety Glasses/Goggles)	X	X	X	X	X	X
	Face Shields	X				X	X
	Gloves	X				X	X
	Protective Clothing	X		X	X	X	
	Respirators with Disposable Filters	X		X	X	X	

Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Hand Tools	Adjustable Wrenches	X		X	X	X	X
	Ball Peen Hammer	X				X	
	Bar Clamps	X					
	Bench Brushes	X		X	X	X	X
	Bolt Cutters					X	
	C-Clamps	X		X		X	
	Center Punch	X				X	
	Claw Hammer	X				X	X
	Cold Chisels	X				X	X
	Coping Saw	X				X	X
	Crescent Wrench Set					X	X
	Desoldering Iron				X	X	
	Divider	X	X	X	X	X	X
	Electronics Vise					X	X
	English Allen Wrenches	X	X	X	X	X	X
	English Wrenches	X	X	X	X	X	X
	Etching System	X				X	X
	File Card	X			X	X	X
	Flat Head Screwdrivers	X	X	X	X	X	X
	Hack Saw	X			X	X	X
	Hand Drill	X	X	X	X	X	X
	Hand Seamer						X
	Hex Wrenches	X	X	X	X	X	X
	Hot Glue Guns	X	X	X	X	X	X
	Level	X	X	X	X	X	X
	Magnets	X	X	X	X	X	X
	Metal Files	X			X	X	X
	Metal Punch	X					X
	Metric Allen Wrenches	X	X	X	X	X	X
	Metric Wrenches	X	X	X	X	X	X
	Nail Set	X					X
	Phillips Screwdrivers	X	X	X	X	X	X
Plastic Mallet	X					X	
Pliers	X	X	X	X	X	X	
Pop Rivet Gun	X			X	X	X	
Rubber Mallet	X					X	
Sanding Blocks	X			X	X	X	

	Scissors	X	X	X	X	X	X
	Scratch Awl	X				X	
	Scribes	X	X	X	X	X	
	Socket Set	X	X	X	X	X	X
	Soldering Equipment	X		X	X	X	X
	Spring Clamps	X	X	X	X	X	X
	Staple Gun	X				X	
	Straight Edges	X	X	X	X	X	X
	Tin Snips	X				X	
	Torque Wrenches					X	
	Triangles	X	X	X	X	X	X
	Try Square	X	X	X	X	X	X
	T-Squares	X	X	X	X	X	X
	Tweezers	X	X	X	X	X	
	Twist Drills	X	X	X	X	X	X
	Utility Knives	X	X	X	X	X	X
	Wire Snips	X	X	X	X	X	X
	Wire Strippers	X	X	X	X	X	X
	Wood Chisels	X	X	X	X	X	X
	Wood Files	X	X	X	X	X	X
	Workbench Vises	X	X	X	X	X	X
	X-acto Knives	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Hand Held Power Tools	Assorted Air Tools	X				X	
	Belt Sander	X				X	
	Buffer	X				X	
	Corded Hand Drill	X	X	X	X	X	X
	Cordless Hand Drill	X	X	X	X	X	X
	Dremel Tool	X	X	X	X	X	X
	Electric Chisels	X				X	
	Grinder- with Wheel	X		X	X	X	
	Hot Air Gun	X	X	X	X	X	X
	Hot Wire Cutter	X	X	X	X	X	X
	Jig Saw	X	X	X	X	X	X
	Laminate Trimmer Bits	X				X	
	Orbital Sanders	X	X	X	X	X	X
	Palm Sander	X	X	X	X	X	X
	Plastic Heat Strip	X				X	X

	Plastics Welder	X				X	
	Pneumatic Nail Gun	X				X	
	Rotary Cutter					X	
	Router	X				X	X
	Router Bits	X				X	X
	Saws All	X				X	
	Sheet Metal Shear	X				X	
	Skill Saw	X					
	Solder Pens	X	X	X	X	X	X
	Solders Gun	X	X	X	X	X	X
	Strip Heater	X				X	
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Material Processing Equipment	3D Printer	X	X			X	X
	Air Compressor (Portable)	X		X	X	X	X
	Autonomous Robot	X	X	X	X	X	X
	Band Saw	X		X	X	X	X
	CIM CELL with Robotic Arm, and Conveyor Belt	X	X			X	X
	CNC Lathe	X				X	
	CNC Mill	X	X			X	X
	CNC Router	X				X	
	Combo Belt/Disc Sander	X		X	X	X	X
	Drill Press	X		X	X	X	X
	Foam Cutter	X	X	X	X	X	X
	Grinder/Wire Wheel Combo	X		X	X	X	X
	Laser Engraver	X	X	X	X	X	X
	Metal Band Saw	X				X	
	Metal Brake	X				X	
	Metal Foot Shear	X				X	
	Metal Lathe	X				X	
	Metal Slip Rollers	X				X	
	MIG Welder	X				X	
	Oxy-Acetylene Unit	X				X	
Planer	X				X		
Plastic Injection Molder	X				X		

	Plastic Vacuum Forming Machine	X				X	
	Scroll Saw	X				X	X
	Sheet Metal Tools	X				X	
	Sliding Compound Miter	X		X	X	X	X
	Small MIG/Arc Welder Combo	X				X	
	Spindle Sander	X		X	X	X	X
	Spot Welder					X	
	Table Saw	X		X	X	X	X
	Thermo Former	X	X			X	X
	TIG Welder					X	
	Vinyl Sign Machine	X	X	X	X	X	X
	Wood CNC Router	X				X	
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Computer Software	2D CAD	X	X	X	X	X	X
	3D Modeling/Design and Analytical	X	X	X	X	X	X
	Animation	X	X			X	X
	Architectural Design	X	X			X	X
	Civil Design	X					
	Classroom Management and Supervision	X	X	X	X	X	X
	Clip Art	X	X	X	X	X	X
	Data Base	X	X	X	X	X	X
	Desktop Publishing	X	X	X	X	X	X
	Electronic Circuit Design	X		X	X	X	X
	Electronics Training and Simulation			X	X		
	Engineering Training	X				X	
	Internet Browser	X	X	X	X	X	X
	MathCAD	X	X				
	Mechanical Workbench	X				X	
	Multimedia and Presentation Graphics	X	X	X	X	X	X
Multimedia Generation and Podcast	X	X	X	X	X	X	

	Parallax Basic Stamp PLC Programming	X		X	X	X	
	PC Control	X	X	X	X	X	X
	Sign or Banner Making	X	X	X	X	X	X
	Spread Sheet	X	X	X	X	X	X
	VEX Easy C PLC Programming	X	X	X	X	X	X
	Video Editing	X	X	X	X	X	X
	Web-Design	X	X	X	X	X	X
	WestPoint Bridge Builder	X	X	X	X	X	X
	Word Processing	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Audio Visual Equipment	Cable TV Access	X	X	X	X	X	X
	Computer Projection System (LCD Projector and Projection Screen)	X	X	X	X	X	X
	Digital Camcorder	X	X	X	X	X	X
	Digital Camera	X	X	X	X	X	X
	Document Camera	X	X	X	X	X	X
	DVD Player	X	X	X	X	X	X
	Interactive or Smart Board	X	X	X	X	X	X
	Interactive Tablet	X	X	X	X	X	X
	Scanner	X	X	X	X	X	X
	Stereo/CD player and Speakers with Surround-sound	X	X	X	X	X	X
	TV Set	X	X	X	X	X	X
	VCR	X	X	X	X	X	X
	Web Access	X	X	X	X	X	X
	Web Camera	X	X	X	X	X	X
	Wireless Mouse	X	X	X	X	X	X
Wireless Pointer	X	X	X	X	X	X	

Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Measuring and Testing Devices	Adjustable Triangles	X	X	X	X	X	X
	Architects Scale	X	X			X	X
	Computer Interfaced Materials/Structural Tester	X	X			X	
	Dial Calipers	X	X	X	X	X	
	Drafting Tools	X	X	X	X	X	X
	Engineering Scale	X	X	X	X	X	X
	Fast Read Thermometers	X	X	X	X	X	X
	Framing Square	X	X			X	X
	GPS Tracking Device	X	X			X	
	Graduated Metal T-Squares	X	X	X	X	X	X
	Large Package Shipping Scale (600lbs)	X				X	X
	Laser Level	X	X	X	X	X	
	Laser Tape Measure	X	X	X	X	X	
	Level	X	X	X	X	X	X
	Measuring Tape	X	X	X	X	X	X
	Metal Rulers	X	X	X	X	X	X
	Meter Sticks	X	X	X	X	X	X
	Metric Rulers	X	X	X	X	X	X
	Micrometers	X	X	X	X	X	X
	Multi-Meters	X	X	X	X	X	X
	Oscilloscopes			X	X		
	Power Supplies			X	X		
	Pressure Sensors			X	X		
	Protractors	X	X	X	X	X	X
	Speed Square	X				X	
	Stopwatches	X	X	X	X	X	X
	Strain/Stress Gage	X	X	X	X	X	X
	Temperature Sensors	X		X	X	X	X
	Transit and Fulcrum	X					
	Triple Balance Beam with Weights	X	X	X	X	X	X
Wind Tunnel	X				X		
Wood Rulers	X	X	X	X	X	X	

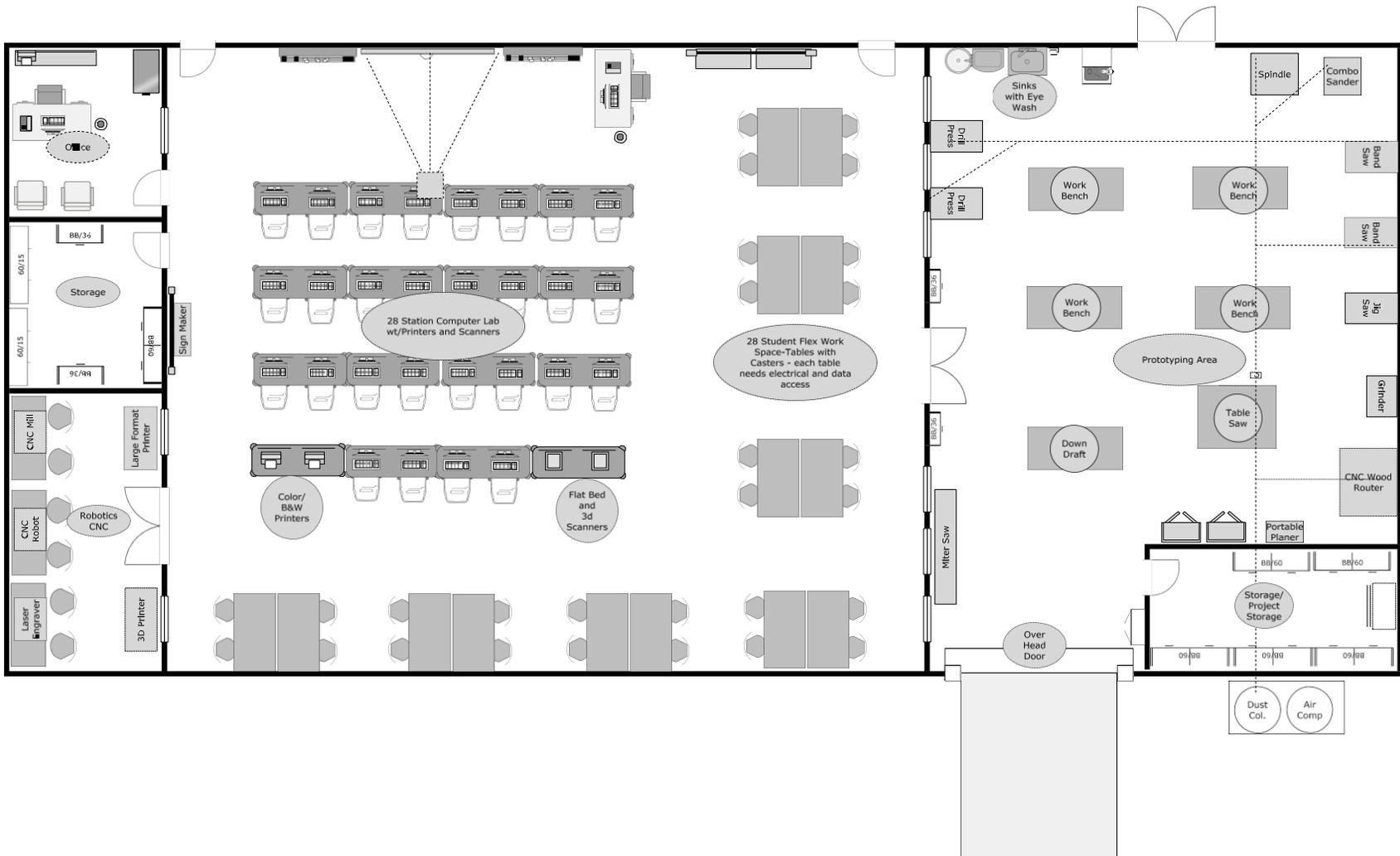
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Computer Hardware	(4) Student Laptops Dedicated for TSA Conference Competitions as well as CNC Equipment and Robotics Programming	X	X	X	X	X	X
	(1) Computer Per Student for a Total of (28hs)(32ms) Student Computers	X	X	X	X	X	X
	(1) Dedicated Computer for Each CNC Machine (Robot, Mill, Lathe, and Laser Engraver) in Addition to the Student Computers	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Instructor	(1) Instructor Laptop	X	X	X	X	X	X
	(1) High Powered Demonstration Computer	X	X	X	X	X	X

Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Printers	(1) Black & White Laser Printer	X	X	X	X	X	X
	(1) Color Laser Printer	X	X	X	X	X	X
	(1) Large Format CAD Printer/Plotter	X	X	X	X	X	X
	(1-4) Inkjet Printer	X					
	(1-2) Scanner/3d Scanner	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy	Electronics	Manufacturing	Middle School
General Lab	(1) Classroom Phone	X	X	X	X	X	X
	(1-2) Video Editing Stations	X	X	X	X	X	X
	(1-2) Digital Still Cameras	X	X	X	X	X	X
	(1-2) Camcorders	X	X	X	X	X	X
	Networked Lab with Internet Connection	X	X	X	X	X	X

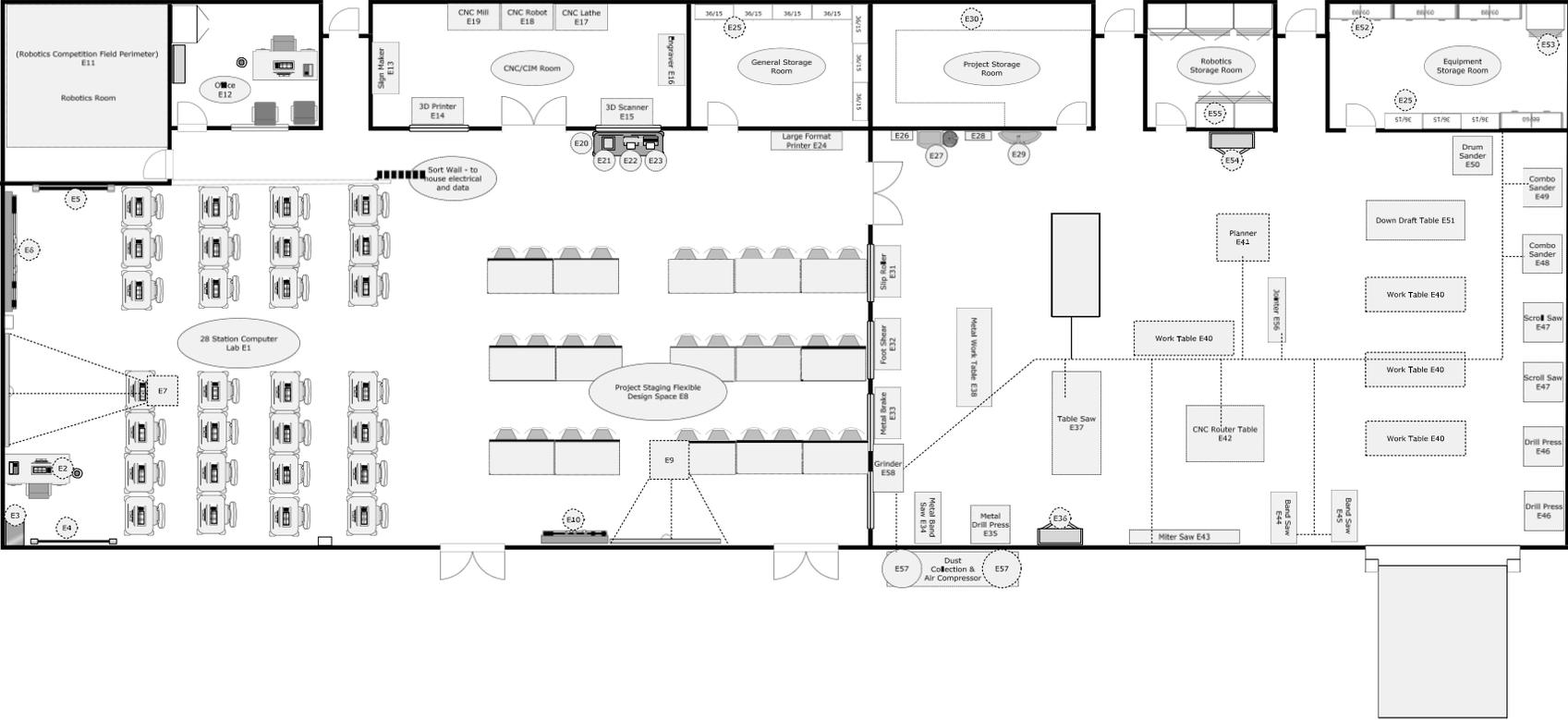
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
Curriculum Related Kits and Instructional Resources	Alternative Energy Systems Kits and Trainers			X	X		
	Automated Manufacturing Equipment	X				X	
	Electrical Motor Kits	X		X	X	X	
	Hydraulics Trainer			X		X	
	Mechanisms Trainer			X		X	
	Pneumatics Trainer			X		X	
	Precision Measurement Trainer	X	X	X	X	X	X
	Sensors and Transducers Kit	X	X	X	X	X	X
	Variety of Electronics Basic Electricity Training Kits (Gibson Tech, Tronix, etc.)	X		X	X	X	X
	Variety of Robotics Trainers (VEX, Lego Mindstorm, etc.)	X	X	X	X	X	X
Area	Description	Engineering	Engineering Graphics and Design	Energy Systems	Electronics	Manufacturing	Middle School
General Needs	3 Hole Punch	X	X	X	X	X	X
	Clear Tape	X	X	X	X	X	X
	Collaboration with Math and Science Teachers	X	X	X	X	X	X
	Colored Markers	X	X	X	X	X	X
	Colored Pencils	X	X	X	X	X	X
	Computer Paper	X	X	X	X	X	X
	Construction Paper	X	X	X	X	X	X
	Dry Erase Markers	X	X	X	X	X	X

Engineering Design Notebooks	X	X	X	X	X	X
Glue	X	X	X	X	X	X
Masking Tape	X	X	X	X	X	X
Office Supplies	X	X	X	X	X	X
Paper Cutter	X	X	X	X	X	X
Partnerships with Local Manufacturers, Business, Engineering Firms, etc	X	X	X	X	X	X
Play Dough	X	X	X	X	X	X
Reverse Engineering	X	X	X	X	X	X
Stapler	X	X	X	X	X	X
State Approved Curriculum	X	X	X	X	X	X
Tissue Paper	X	X	X	X	X	X
Waste Paper Baskets	X	X	X	X	X	X
Recycle Bin	X	X	X	X	X	X

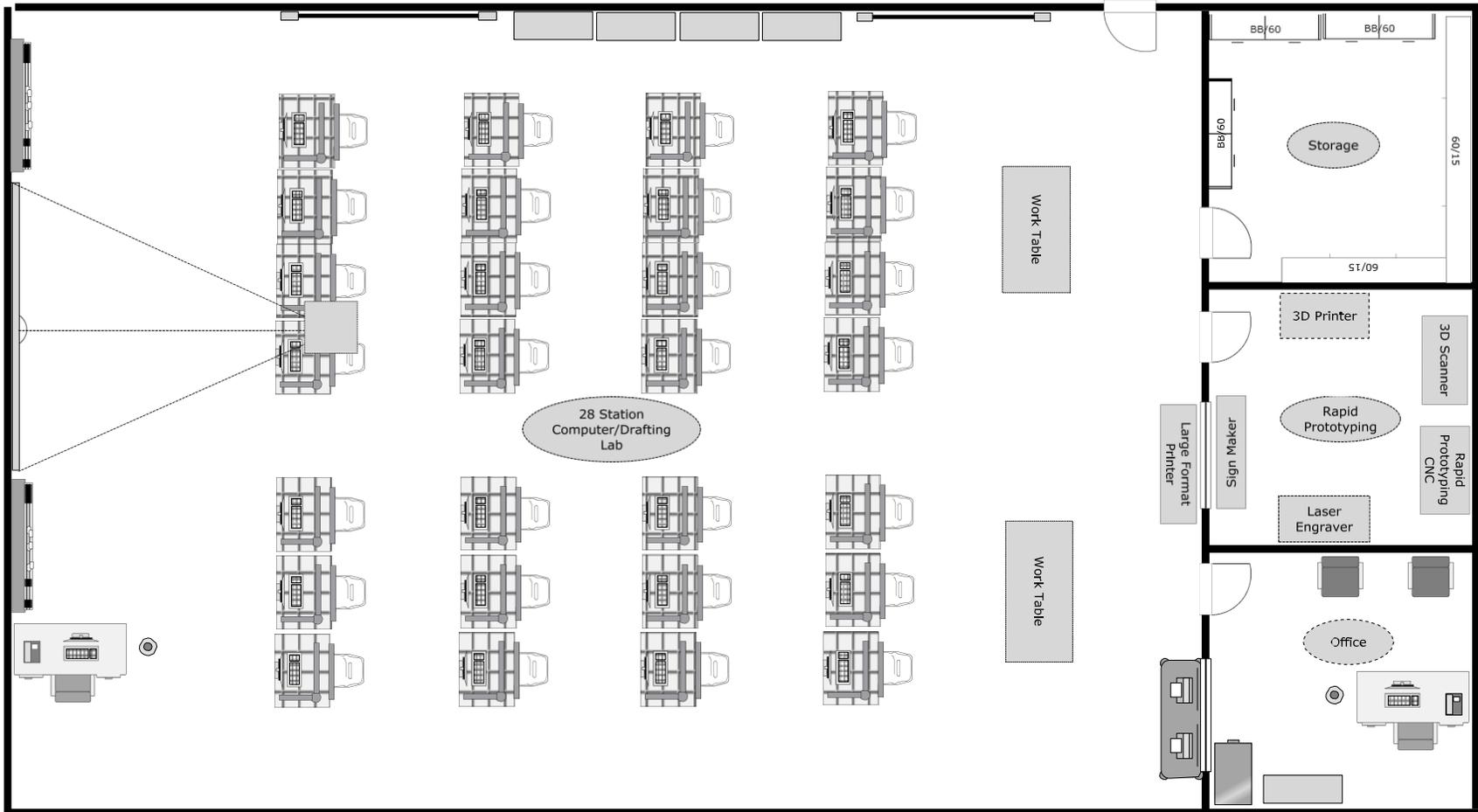
SAMPLE ENGINEERING LAB LAYOUT



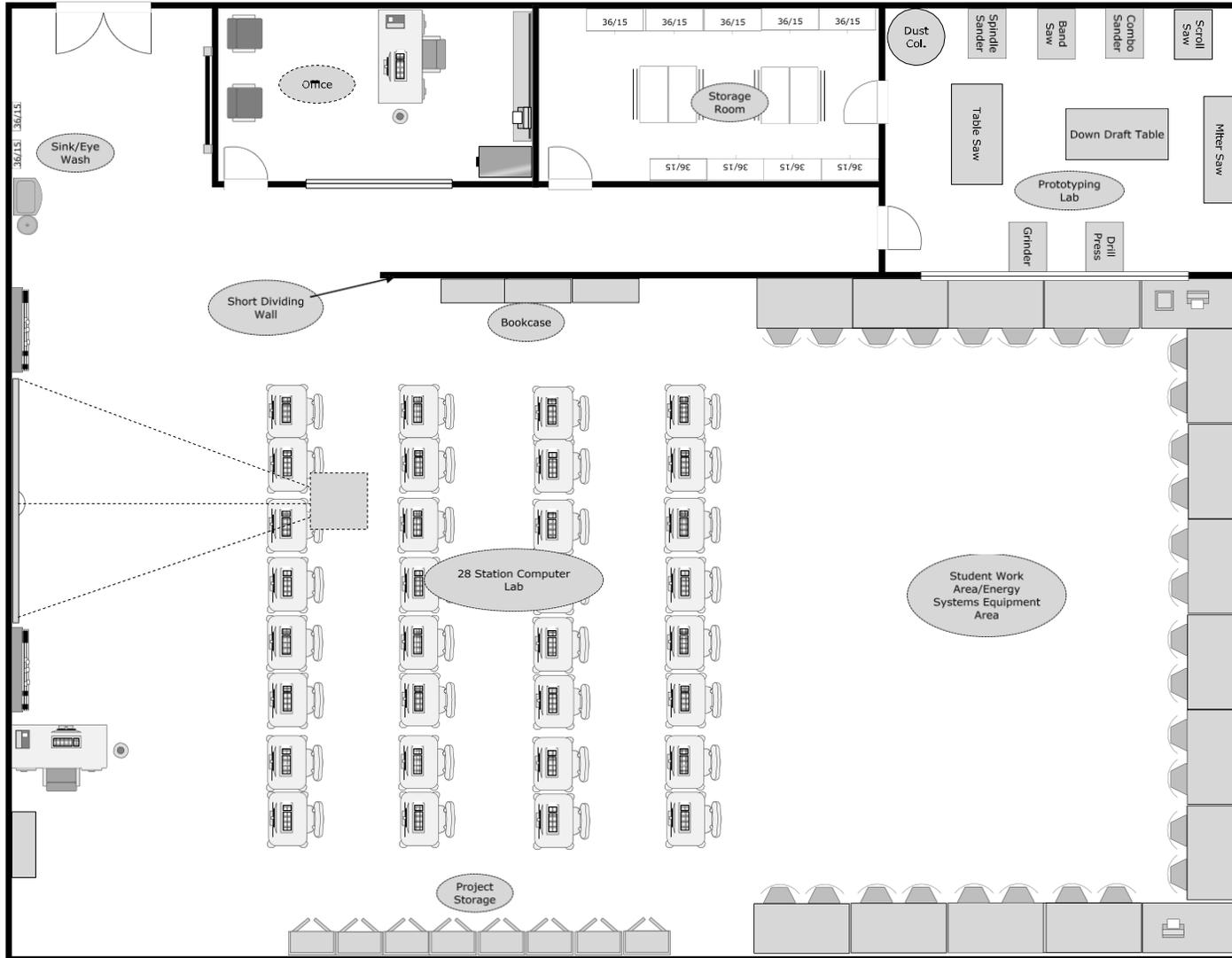
SAMPLE OPTIMUM ENGINEERING LAB LAYOUT



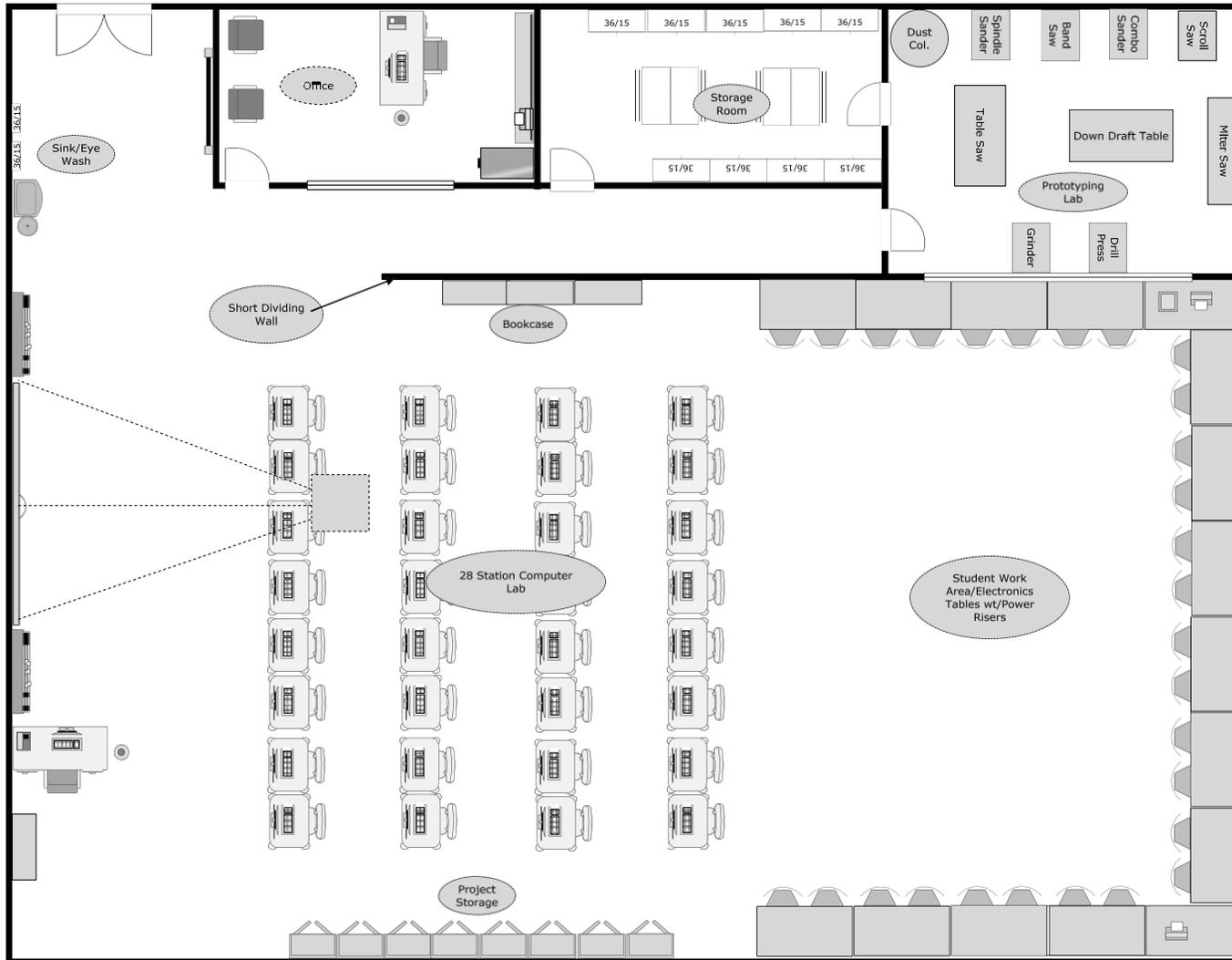
SAMPLE ENGINEERING GRAPHICS AND DESIGN LAB LAYOUT



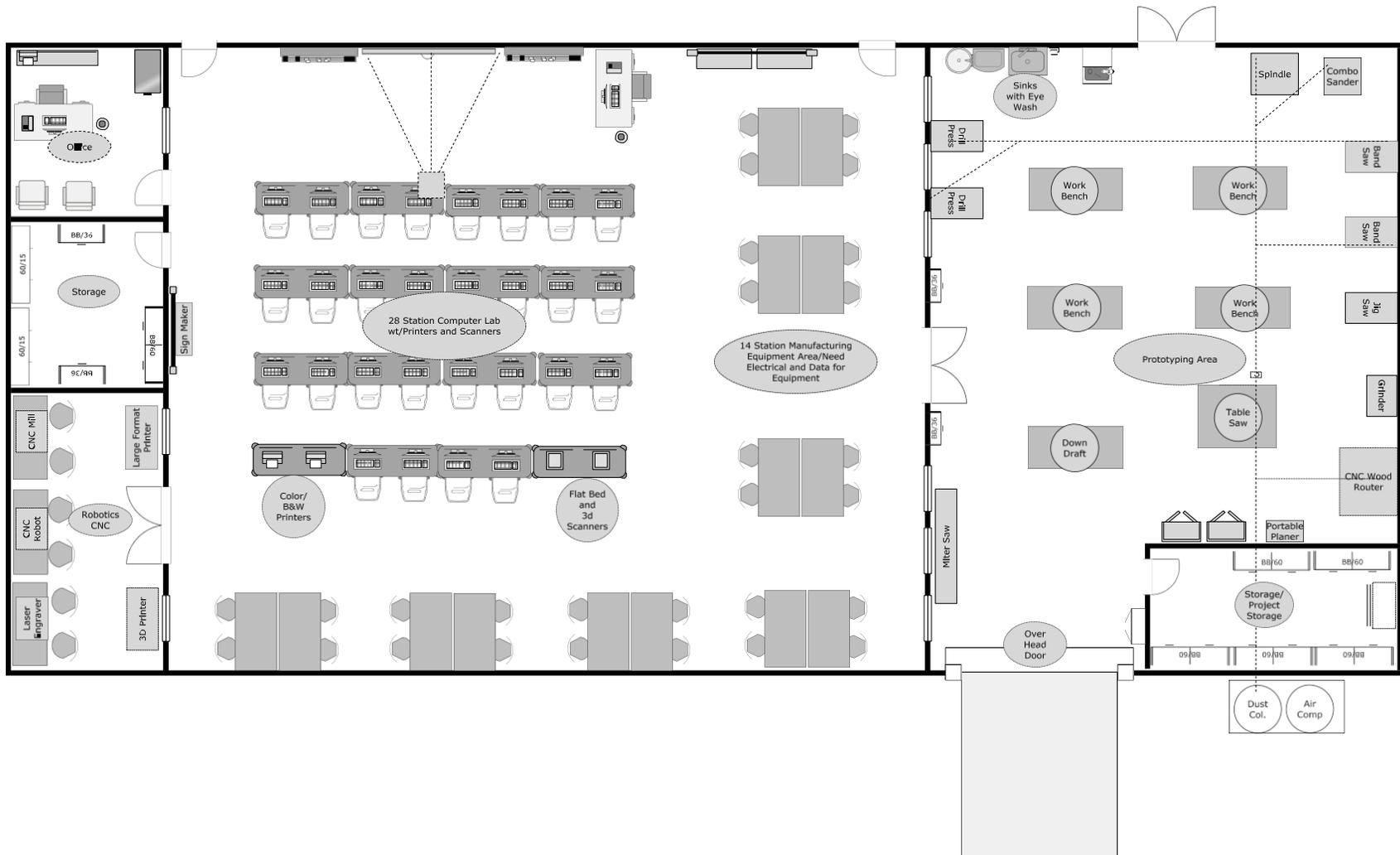
SAMPLE ENERGY SYSTEMS LAB LAYOUT



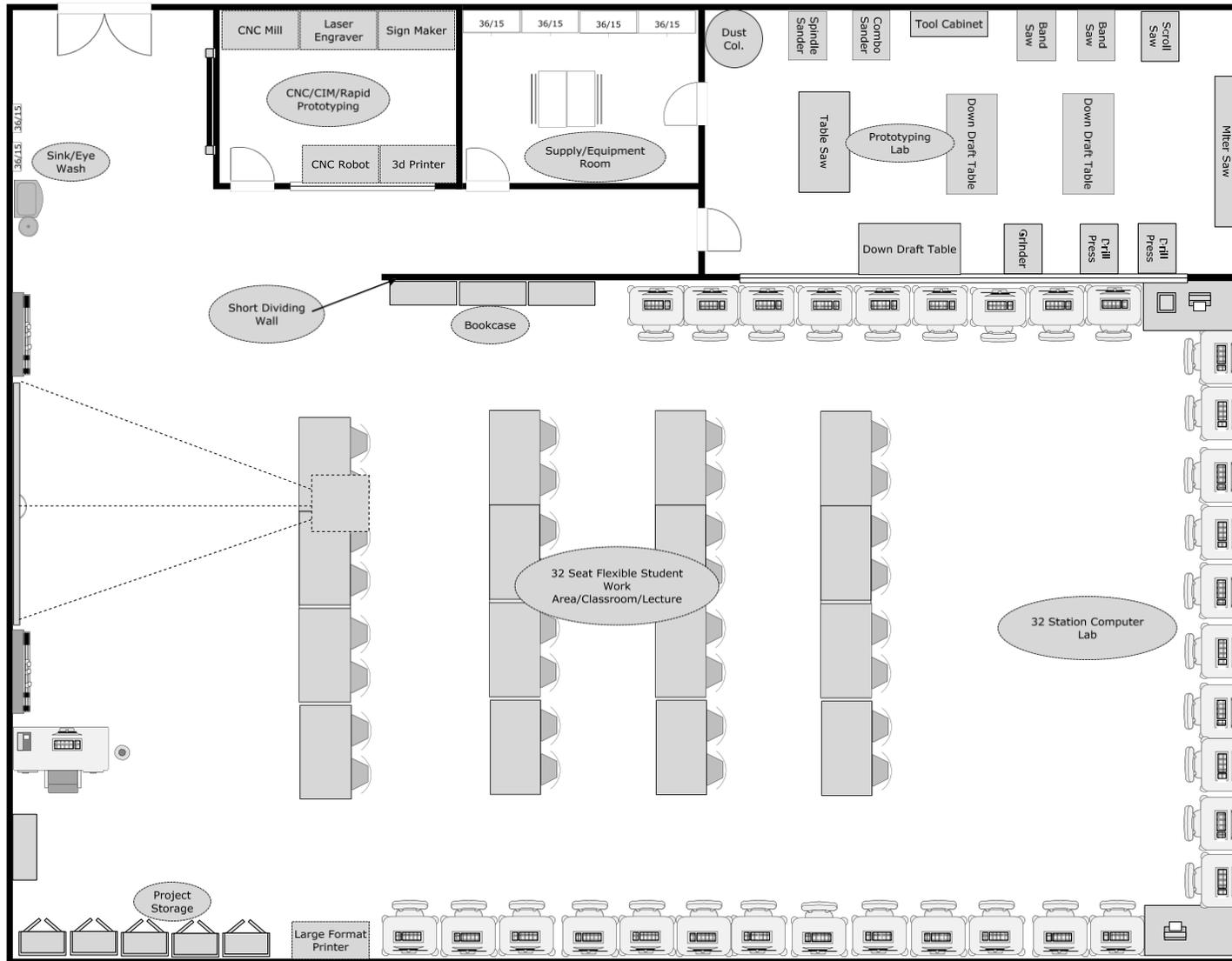
SAMPLE ELECTRONICS LAB LAYOUT



SAMPLE MANUFACTURING LAB LAYOUT



SAMPLE MIDDLE SCHOOL ENGINEERING AND TECHNOLOGY LAB LAYOUT



APPENDIX A

PROFESSIONAL LAB DRAWINGS

