This combination progress record and course outline is designed for use by individuals teaching a course in avionics that is intended to prepare students for employment in the field of aerospace electronics. Included among the topics addressed in the course are the following: shop practices, aircraft and the theory of flight, electron physics, fundamentals of electricity, Federal aviation regulations, technical math, graphics, electrical circuits and systems, aircraft static and vacuum systems, aircraft pilot systems, semiconductor devices, power supplies, radios and radio transmission, test equipment and precision measurements, electronics, computers, computer programming, microprocessors, motors and generators, aircraft communication, navigation, flight control systems, and turbulence and flight collision avoidance. In addition to the theory outline, which includes space for recording information concerning the scheduling and presentation of the lesson material, this record book also contains a list of course objectives and a grid for use in recording the individual student's mastery of each specific skill taught in the course. (MN)
PROGRESS RECORD

AND

THEORY OUTLINE

AVIONICS

DIVISION OF VOCATIONAL-TECHNICAL SCHOOLS

CONNECTICUT DEPARTMENT OF EDUCATION

1983-1984
PREFACE

The objective of this Assignment Book is to reduce unnecessary paperwork on the part of the shop instructor.

The Avionics Assignment Book accomplishes this by increasing the instructor's ability to plan and organize in advance and in keeping student records together and up to date.

A list of preferred hands-on exercises and experiments is included to be used at the discretion of the individual instructor.

This outline is not to be construed to be inflexible as to the material content or order of presentation.
GENERAL COURSE OBJECTIVES

Avionics is a program designed to provide vocational preparation for entry into the highly technical field of Aero-Space Electronics.

It provides both the theoretical background and the practical skills of servicing, installation, adjustments and troubleshooting techniques.

The course will develop in the student skills that are necessary to enter the Avionics field at the trainee level.

The program prepares the student for the Federal Communication Commission's General Radio-telephone Licensing examination.
PRIMARY OBJECTIVES

The student should be able to:

1. Demonstrate good safety practices at all times.
2. Use common hand tools and power tools of the trade.
3. Use basic electronic instruments.
4. Apply theories of electricity, electrostatics, electron physics, and magnetism.
5. Demonstrate elementary direct current circuits and their protective devices.
6. Demonstrate basic knowledge of aviation wiring practices and installation procedures.
7. Demonstrate a basic knowledge of technical math associated with Avionics.
8. Demonstrate a basic knowledge of drafting fundamentals, schematics, blueprints, and wiring diagrams associated with Avionics.
10. Demonstrate a knowledge of basic alternating current, inductance, capacitance and resonance.
11. Use basic semiconductor and integrated circuit fundamentals.
12. Demonstrate a basic knowledge of aviation flight instruments.
13. Demonstrate a knowledge of aircraft electrical power generation and distribution.
15. Demonstrate a knowledge of fundamental digital circuits.
16. Demonstrate a knowledge of fundamental microprocessor circuits.
17. Demonstrate a knowledge of fundamental microprocessor interfacing.
18. Demonstrate a knowledge of operation of aviation type receivers and transmitters.
19. Demonstrate a basic knowledge of operation of aircraft electronics navigation devices.
20. Demonstrate a basic knowledge of operation of aircraft pulse and microwave systems.
21. Apply FAR PART 43.
22. Apply FCC regulations in regard to aviation.
23. Demonstrate a knowledge of aircraft flight control systems.
24. Demonstrate knowledge of emergency location transmitters.
25. Demonstrate knowledge of VLF, LF and Loran Navigation systems.
27. Demonstrate knowledge of Avionic transmission lines and antenna systems.
28. Demonstrate knowledge of air traffic control procedures for both VFR and IFR Flying.
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<p>| Select and install protective devices |
| Size cable |
| Clamp cable |
| Lace cable |
| Install solderless connectors |</p>
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INTEGRATED CIRCUIT
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<td>Construct NOR gate circuit</td>
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<td>Construct NAND gate circuit</td>
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<td>Construct astable multi-vibrator circuit</td>
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For future use, dependent on available training equipment

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<td>A.C. GENERATORS</td>
<td>Construct simple A.C. generator</td>
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</table>
Construct simple A.C. motors
Chart characteristics

Tune & adjust VHF transmitter
Tune & adjust VHF receiver

Tune & adjust singlesideband transmitter
Tune & adjust singlesideband receiver

A. C. MOTORS
AIRCRAFT COMMUNICATIONS
Mount wire, install and complete FAA paperwork on:

1. VHF transmitter
2. VHF receiver
3. Singlesideband transmitter
4. Singlesideband receiver
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<td>1. Loran C</td>
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<td>7. D.M.E.</td>
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<td>6. Radar altimeter</td>
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<td>7. D.M.E.</td>
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MAJOR UNITS OF THEORY

I. ORIENTATION
II. SHOP PRACTICES
III. AIRCRAFT FAMILIARIZATION
IV. THEORY OF FLIGHT
V. ELECTRON PHYSICS
VI. FUNDAMENTALS OF ELECTRICITY
VII. FEDERAL AVIATION REGULATIONS
VIII. TECHNICAL MATH
IX. GRAPHICS
X. D. C. CIRCUITS
XI. METERS
XII. BATTERIES
XIII. MAGNETISM
XIV. AIRCRAFT SHEETMETAL PRACTICES
XV. INSTALLATION OF ELECTRICAL SYSTEMS
XVI. A. C. FUNDAMENTALS
XVII. BASIC TRIGONOMETRY
XVIII. INDUCTANCE
XIX. CAPACITANCE
XX. RESONANCE
XXI. AIRCRAFT STATIC SYSTEM
XXII. AIRCRAFT PITOT SYSTEM
XXIII. AIRCRAFT VACUUM SYSTEM
XXIV. SEMICONDUCTOR DEVICES
XXV. OTHER SEMICONDUCTOR DEVICES
XXVI. POWER SUPPLIES
XXVII. AUDIO AMPLIFIERS
XXVIII. RADIO FREQUENCY AMPLIFIERS
XXIX. SINE WAVE OSCILLATORS
XXX. NON-SINOUSIDAL WAVEFORMS
XXXI. TRANSMITTERS
XXXII. RECEIVERS: AM AND FM
XXXIII. TEST EQUIPMENT AND PRECISION MEASUREMENTS
XXXIV. ANTENNAS AND WAVE PROPAGATION
XXXV. FCC REGULATIONS
XXXVI. INTEGRATED CIRCUITS
XXXVII. DIGITAL ELECTRONICS
XXXVIII. COMPUTERS
XXXIX. INTRODUCTION TO PROGRAMMING (SOFTWARE)
XXYV. MICROPROCESSORS (HARDWARE AND SOFTWARE)
XXXX. OPERATIONAL AMPLIFIERS
XXXXII. TRANSDUCERS
XXXXIII. MOTORS AND GENERATORS
XXXXIV. AIRCRAFT COMMUNICATIONS
XXXXV. AIRCRAFT NAVIGATION
XXXXVI. PULSE AND MICROWAVE SYSTEMS
XXXXVII. FLIGHT CONTROL SYSTEMS
XXXXVIII. TURBULANCE AVOIDANCE
XXXXIX. FLIGHT COLLISION AVOIDANCE
L. AIR TRAFFIC CONTROL PROCEDURES
THEORY OUTLINE

I. ORIENTATION

A. Occupational Analysis
   1. Development of the Avionics Industry
   2. Employment opportunities
   3. Employment requirements and trade practices
   4. Federal Aviation Administration
   5. Federal Communication Commission

II. SHOP PRACTICES

A. Care and Use of Common Hand Tools
   1. Safety

B. Care and Use of Air and Electric Power Tools
   1. Safety

C. Wire Stripping, Splicing and Soldering Techniques
   1. Safety

D. Safety Around Aircraft
   1. Propeller
   2. Fuel
   3. Jet intake and exhaust
   4. Helicopter blades and tail rotor
   5. Aircraft wing and tail surfaces
   6. Retractable gear

III. AIRCRAFT FAMILIARIZATION

A. Types
   1. Fixed wing
      a. Single
      b. Multi
      c. Glider
      d. Ultra light
   2. Rotor Craft
      a. Helicopter
      b. Autogyro
   3. Lighter than air
B. Construction
1. Metal
2. Wood
3. Fabric
4. Fiberglass

C. Cockpit
1. Instrument panel
2. Controls
3. Cockpit safety

D. Power Plants
1. Piston
2. Turbo\textsubscript{dron}
3. Turbine
4. Safety

IV. THEORY OF FLIGHT
A. Aircraft Controls
B. Forces on Airplane in Flight
C. Load Factors and Safety

V. ELECTRON PHYSICS
A. The Nature of Matter
   1. States and forms of matter
      a. Molecule
      b. Atom
      c. Compound
      d. Element

B. Atomic Structure
   1. Sub-atomic particles
      a. Charges
      b. Physical arrangement
   2. Differences between atoms
      a. Conductors and non-conductors
      b. Stable and unstable atoms
      c. Neutral atoms and ions
VI. FUNDAMENTALS OF ELECTRICITY

A. Electrostatics
   1. Law of charges
   2. Effect of distance on two charges
   3. Electrostatic fields

B. Dynamic Electricity
   1. Sources
   2. Fundamental circuit factors
      a. EMF
      b. Current
      c. Resistance
      d. Power
   3. Electrical units
      a. Coulumb
      b. AMP
      c. Volt
      d. Ohm
      e. Watt
      f. Mho
   4. Use and care of meters
      a. Safety
      b. Volt meter
      c. Ohmmeter
      d. Ammeter
   5. Fundamental Laws
      a. Ohm's Law
      b. Joule's Law
   6. Simple circuits
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      b. Opens
      c. Overloads
   7. Resistance
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      b. Power ratings
      c. Effects of length, diameter, material, temperature
      d. Circular mil foot
      e. Wire table
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   B. Part 43
   C. Part 65
   D. Part 91
   E. Part 145

VIII. TECHNICAL MATH
   A. Signed Numbers
      1. Addition
      2. Subtraction
      3. Multiplication
      4. Division
   B. Power of Ten
      1. Positive and negative exponents
      2. Common electronic prefixes
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         b. MICRO, NANO, PICO
      3. Multiplication and division
   C. Electronic Calculator
      1. Multiplication
      2. Division
      3. Square roots
      4. Trig functions
      5. Memory

IX. GRAPHICS
   A. Drafting Fundamentals
      1. Aircraft electrical symbols
      2. Blueprints
      3. Wiring diagrams

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      2. Basic rules
B. Parallel Circuits
   1. Definition
   2. Basic rules
   3. Effects on opens and shorts

C. Complex Circuits
   1. Definition
   2. Kirchoff's Law
   3. Superposition
   4. Bridge circuits

XI. METERS
   A. Fundamentals of Meter Movements
   B. D. C. Meter Circuits
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      2. Ammeter circuits
      3. Ohmmeter circuits
      4. Single and multi-range
      5. Calculations of multiplier and shunt resistors
   C. Loading Effects

XII. BATTERIES
   A. Cells
      1. Primary
      2. Secondary
   B. Types
      1. Advantages
      2. Disadvantages
   C. Use and Care
      1. Charging
      2. Testing
      3. Connecting in series and parallel

XIII. MAGNETISM
   A. Fundamentals
      1. Magnet and non-magnetic materials
      2. Basic laws of magnetism
      3. Strength
      4. Magnetic fields
      5. Coulomb's Law
      6. Classification of materials
B. Electromagnetism
1. Definition
2. Fundamentals
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   b. Left hand rule

XIV. AIRCRAFT SHEETMETAL PRACTICES
A. Tools
1. Floor and bench
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   b. Nibbling machine
   c. Breaks
   d. Band saw
   e. Drill press
2. Hand air and electric power tools
   a. Drills
   b. Screwdrivers
   c. Sheetmetal shears
   d. Sabre saws
   e. Grinders
   f. Rivet tools
3. Hand tools
   a. Hammers
   b. Hand snips and shears
   c. Mallets
   d. Punches
   e. Hand rivet set
   f. Chisels
   g. Dividers
   h. Pliers
   i. Rulers
   j. Wire and sheetmetal gages
   k. Hacksaw
   l. Scribe
   m. Files
4. Riveting
   a. Types
   b. Rivet code
   c. Temper designation
   d. Installing rivets
5. Riveting Practices
   a. Sizes
   b. Spacing
   c. Number of rivets required
   d. Dimensions
   e. Bucking bar
   f. Use of rivet gun
   g. Sheet fasteners
   h. Removing rivets

6. Special Rivets
   a. Need
   b. Types

XV. INSTALLATION OF ELECTRICAL SYSTEMS

A. Electrical System Requirements
   1. General
   2. Protective devices
   3. Safety and emergency
   4. Electrical load

B. Electrical Wiring
   1. Cable characteristics
   2. Cable size
   3. Current carrying capacity
   4. Requirements for open wiring
   5. Cable lacing
   6. Cable clamping
   7. Routing of electrical cable
   8. Electrical conduit

C. Connecting Devices
   1. Cable terminals
      a. Crimp terminals
      b. Solder terminals
      c. Advantages and disadvantages
   2. Connectors
      a. Solder connectors
      b. Crimp connectors
      c. Advantages and disadvantages
   3. Electrical terminal strips
      a. Solder type
      b. Screw lug type
      c. Punch pin type
   4. Potting
D. Switches and relays

E. Circuit protecting devices
   1. Fuses
   2. Circuit breakers
   3. Over voltage cutouts

F. Bonding and sheilding

G. Wire identification
   1. Adhesive tape
   2. Heat shrink tubing labels
   3. Hot stamp labeling

H. Typical systems
   1. Simple electrical systems
   2. Alternator circuits
   3. Battery and starter circuits

XVI. A. C. FUNDAMENTALS

A. Definition

B. Generation of AC
   1. Lenz's Law
   2. Left hand rule
   3. Fundamental factors needed to generate a voltage
   4. Factors determining the strength of induced E.M.F.
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