



BID DOCUMENT FOR THE PURCHASE OF CBT, MOCK- UPS
AND WORKSHOP FACILITIES FOR ETHIOPIAN AVIATION
ACADEMY-AVIATION MAINTENANCE TRAINING - TTF
PROJECT

January 2018

Ethiopian Airlines

Foreword

A member of the Star Alliance, Ethiopian Airlines, the fastest growing Airline in Africa currently has a more than 80 aircrafts serving above 93 international and 20 domestic destinations across Africa, the Middle East, Asia and North America, with a further 43 aircrafts on order. Its current fleet is composed of 13 xB 787, 4x B 777-300ER, 6x B 777-200LR, 5x B 777F (cargo), 7xB767-300, 5x B737-700NG, 14x B737-800W, 17x DHC8-Q400 NextGen..

Ethiopian is pursuing an aggressive growth plan in line with a 15 years strategic road map. During this period, it aims to increase its international destinations by more than 50% and its fleet size by 200%.As part of this growth plan Ethiopian is currently started receiving the ordered Airplanes.

To support its aggressive growth strategy, Ethiopian Airlines wants to enter in a global strategic agreement with a supplier of the subject bid selected through a competitive bid process.

This tender document is therefore meant for selecting appropriate suppliers to get the intended service. Ethiopian Airlines, therefore, is looking for supplier/s that meets the standard so as to be eligible for the selection as a winner in a contractual agreement bases.

PART - ONE
INVITATION TO TENDER
ADDIS ABABA, ETHIOPIAN AVIATION ACADEMY -TTF PROJECT, FOR THE SUPPLY,
CBT, MOCK-UPS AND WORKSHOP FACILITIES FOR -AVIATION MAINTENANCE
TRAINING (Airframe, Power plant & Avionics) department

1. INTRODUCTION AND SUBJECT OF THE TENDER

- 1.1 Ethiopian Airlines whose principal address is ADDIS ABABA, ETHIOPIA, P.O. Box 1755 BOLE INTERNATIONAL AIR PORT, (hereafter also called ETHIOPIAN or ET) intends to invite bidders for the supply of CBT, MOCK-UPS AND WORKSHOP FACILITIES FOR ETHIOPIAN AVIATION ACADEMY-AVIATION MAINTENANCE TRAINING (Airframe, Power plant & Avionics) Departments as per the specification described in Part Two Technical requirement.

2. INSTRUCTION TO BIDDERS:

- 2.1 Bidders shall submit their proposals in two copies marked “**Original**” and “**Duplicate**” for both the technical and financial proposals. The proposal marked “**Original**” shall be the master copy of the tender. If there is any discrepancy between the “**Original**” and the copy marked “**Duplicate**”, the entries on the original shall be deemed correct.
- 2.2 Bidders are required to submit their technical and financial proposals in separate envelopes and enclose these envelopes in outer envelopes for both the original and the duplicate. The outer envelopes shall be sealed and be labeled as “**BID DOCUMENT FOR THE SUPPLY OF CBT, MOCK-UPS AND WORKSHOP FACILITIES FOR ETHIOPIAN AVIATION ACADEMY-AMT (Airframe, Power plant & Avionics) DEPARTMENT.**” and deliver to the address:

*ETHIOPIAN AIRLINES ENTERPRISE
BOLE INTERNATIONAL AIRPORT
ADDIS ABABA, ETHIOPIA
Procurement and Supply Chain Management,
Strategic Sourcing Non-Technical
ATTN: Limenih Gashaw
Tel: 251-11 5174483/8953*

2.3 The bid will be closed on **Feb 8/2018** at **2:00PM** and opened on the same date at **3:00PM** at Procurement and Supply Chain Management office, Ethiopian Airlines Headquarter in Addis Ababa, Ethiopia.

2.4 Bidders shall provide proposal for detail supply, installation and commissioning of the subject

2.5 Bidders shall provide company profile and previous work experience on similar projects.

2.6 Clarification of Proposal Document

The prospective bidders requiring clarification for this proposal shall contact ETHIOPIAN in writing by E-mail: LimenhG@ethiopianairlines.com. ETHIOPIAN will ensure that all such requests are responded on time if the bid committee receives the written request 5 working days before the deadline of submission of the bid.

The clarification will be communicated to all potential bidders without disclosing the source of the query, as deemed necessary.

2.7 Preparation of Tender

- All signing, witnessing and initialing is to be in ink. All offers and schedules are to be in typescript.
- The person who signs on any offer or document should be a person duly authorized by the bidders.
- Complete Proposal

Bidders are expected to examine all the instructions, specifications and the options preferred by ETHIOPIAN, as indicated in this document. **Failure to fulfill the requirement of the specification may result in rejection of the bid.**

- Cost of Proposal

Bidders shall bear all costs associated with the preparation and submission of their proposals. ETHIOPIAN will in no case be responsible or liable for any cost, regardless of conduct or the outcome of the bid evaluation.

3. PRICING AND PAYMENT SCHEDULE

3.1 The price shall include taxes, duties etc...applicable in the country of shipment origin.

3.2 The prospective vendor shall indicate the preferred terms and mode of payment for and related costs. ETHIOPIAN preferred payment schedule is within 30 days after delivery of the device. Letter of Credit (L/C) is not applicable by Ethiopian. If advance payment is requested then it can be entertained against the delivery of unconditional bank guarantee equivalent to the requested amount of advance and shall not exceed 20% of the total cost/contract value.

3.3 All bidders are required to write the detail cost break down of each work (supply, Installation and commissioning) of each CBT, Mock-ups and workshop facilities.

3.4 The prospective vendor shall give price for after sales support beyond the warranty period.

3.5 Training separately includes in the price.

4. SUPPORT

Bidders shall provide details on the technical support beyond the warranty period after installation and commissioning of the device and other alternative support arrangements if any.

5. WARRANTY

The prospective vendor shall warrant that the device will perform properly in accordance with the accompanying user manual and related materials and will be free from defects in material and workmanship, for a period as specified by the bidder starting from date of delivery.

Warranty period and support details shall clearly be indicated.

6. IMPLEMENTAION PLAN OR WORK SCHEDULE

6.1 The perspective bidder shall deliver and install the device after placing the purchase order.

6.2 Production time shall be clearly shown on the proposal

7. TRAINING

Bidders shall indicate the necessary training for effective operation and maintenance of the device, preferred venue and mode of training.

7.1 **Maintenance training**:- the training must include both theory of operation and effective practical session in which it enable the trainee to maintain and administer the equipment properly course general contents shall be supplied.

7.2 **Simulator Instructor training**: - the simulator instructor requires proper familiarization to ISO (Instructor Operation System) will all commands during training session setup.

8. COMPANY PROFILE

Copies of company profile inclusive of the last three years audited financial report and reference list shall also be attached with the technical proposal.

TECHNICAL EVALUATION

8.1 **Responsiveness to specification**: bidders shall be responsive to the Specification.

8.2 **Spare parts and after sales services**: Bidders shall indicate spare parts supply and after sales service.

8.3 **Additional features**: If additional feature not listed in ETHIOPIAN specification is offered by any bidder and same is believed to be beneficial, then it will be considered.

8.4 Only technically responsive bidders and that score the minimum technical pass point or more will be considered for financial evaluation.

9. FINANCIAL EVALUATION

The financial evaluation shall consider the following:

9.1 Bid price

9.2 Delivery point

9.3 Delivery Schedule: - If the manufacturer could not provide simulator on the specific date and place, the manufacturer shall be responsible/liable for the delay.

9.4 Payment schedule

10. BID AWARD

ETHIOPIAN shall notify the winner in writing and those bidders who have not succeeded in winning the bid shall also be notified.

11. CANCELLATION OF BID

ETHIOPIAN Airlines has the right to cancel/modify this bid entirely or partially without prior notification.

PART - TWO

Technical Requirement

This part contains technical specifications for aircraft system trainers, test bench, CBT (computer based training), classroom posters and other equipment. The specifications are divided into three parts; namely airframe, avionics and power plant.

1. Airframe

1.1. Aircraft system trainers

1.1.1. Fluid lines and fittings trainer

- The Trainer should use actual aircraft system components
- Should be mounted on easy-to-roll display stand
- Should illustrate types of fitting and line assembly techniques used in aviation maintenance
- Should display correct and incorrect methods of constructing rigid lines and flexible hoses
- Should illustrate and contrast AN, AC, MS, and pipe thread fittings
- Should have a complete with tool kit, different types of AN fittings, MS fittings, line to hose connections, flexible lines, and rigid lines.
- Should include fitting, line and hose cutaways to show the construction of various components.

1.1.2. Air cycle air conditioning system trainer

The trainer should;

- Be fully functional; with functioning components that simulate the workings of a typical air cycle air conditioning system
- Provide mechanisms for hands-on training
- Use actual aircraft system components

- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory body requirements (EASA/FAA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (have castors)
- Have simulated fault insertion
- System faults through an instructor’s panel
- Be easily maintainable with accessible spares
- Feature a basic turbine air cycle system and show how it provides cabin climate control
- At least include
 - ◆ Air cycle machine (ACM)
 - ◆ Primary and Secondary Heat Exchangers
 - ◆ Water Separator
 - ◆ Over Temp Sensor
 - ◆ Temperature sensor
 - ◆ Temperature control valves
 - ◆ Digital display of the temperatures of the cabin chamber, bleed air, and ambient air controller
 - ◆ ACM bypass valve
 - ◆ Cabin ventilation blower
 - ◆ Lag chamber
 - ◆ Simulated bleed air source
 - ◆ Humidity control mechanism
 - ◆ Temperature indication displays
 - ◆ Hot/Cold Air control switches

1.1.3. Vapor cycle air conditioning and heating system

The trainer should;

- Be fully functional; with functioning components that simulate the workings of a typical vapor cycle and heating system
- Provide mechanisms for hands-on training

- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory body requirements (EASA/FAA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (have castors)
- Have simulated fault insertion
- Feature all applicable relays, switches, and controls to operate the system as well as an APU plug
- Have wiring diagrams to assist troubleshooting simulated system malfunctions
- Be easily maintainable with accessible spares

1.1.4. Turbine fuel system trainer

The trainer should

- Be fully functional; with functioning components that simulate the workings of a typical turbine engine fuel system
- Provide mechanisms for hands-on training
- Use actual aircraft system components typical of turbine engine fuel system
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory body (FAA, EASA) curriculum requirements
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Supported on a durable frame which can easily be moved (have castors)
- Configured like a typical turbine engine fuel system; left and right fuel tanks, fuel quantity indicators, boost pumps, valves,

flexible and rigid lines engine driven pump, fuel metering units, dump valves, nozzles

- Contain necessary cockpit indications; fuel quantity indicator, fuel pressure, fuel temperature
- Contain valve switches
- Have fault insertion provisions for troubleshooting exercises
- Have circuit breakers switches and electrical components
- Be easily maintainable with accessible spares

1.1.5. Motorized hydraulic system trainer

The trainer should

- Be fully functional; with functioning components that simulate the workings of a typical hydraulic system
- Provide mechanisms for hands-on training
- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory body curriculum requirements (FAA, EASA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (have castors)
- Have fault insertion provisions for troubleshooting exercises
- Have provision for every component to be removed, overhauled, reinstalled, and functionally tested
- Have Fluid Reservoir, Rotary vane or gear hydraulic pump with electrically driven motor, Aircraft hydraulic cylinder (dual acting), sequenced by a sequencing valve, Pressure Gauge (direct reading), valves, Hand Pump, Filter Assembly, Pressure relief valve, Accumulator Assembly
- Have large, laminated, colored schematic poster of system plumbing
- Demonstrate the principle of hydraulic-actuated flight controls

- Be easily maintainable with accessible spares

1.1.6. Ice and rain protection trainer

The trainer should;

- Be fully functional; with functioning components that simulate the workings of a typical hydraulic system
- Provide mechanisms for hands-on training
- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory body curriculum requirements (FAA, EASA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (have castors)
- Have fault insertion provisions for troubleshooting exercises
- At least include the following sub systems
 - ◆ Windshield Wiper System
 - ◆ Windshield De-Icing (Alcohol Dispensing)
 - ◆ Pitot Tube with electrical heating elements
 - ◆ Propeller De-Icing System
 - ◆ Pneumatic De-Ice Boot System
 - ◆ Electrically Heated Airfoils (Anti-icing)
 - ◆ Pneumatically Heated Airfoils (Anti-icing)
- Be easily maintainable with accessible spares

1.1.7. Hydraulic landing gear system trainer

The trainer should;

- Be fully functional; with functioning components that simulate the workings of a typical hydraulic landing gear system
- Provide mechanisms for hands-on training
- Use actual aircraft system components

- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with regulatory curriculum requirements
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Have a durable frame which can easily be moved (has castors)
- Be easily maintainable with accessible spares
- At least have the following features
 - ◆ Hydraulically operated retractable L/G with operational strut
 - ◆ Hydraulically operated landing gear door
 - ◆ Sequencing controlled through squat switches and sequencing valves
 - ◆ Used to demonstrate a typical hydraulic system operation in addition to the landing gear operation
 - ◆ Should have Flap and landing controls
 - ◆ Should have a wing section
 - ◆ Hydraulically operated flap with electrical indication system
 - ◆ The system should include an electrical motor & a mechanical pump with all associated components (pressure regulator, relief valve, check valves, reservoir and a filter assembly)
 - ◆ Should have a full function brake system with parking brake operation
 - ◆ Landing gear indication should include: gear up, gear down and in-transit
 - ◆ Throttle lever with associated components should complete the warning circuit of gear up warning horn
 - ◆ Should have an emergency hand pump
 - ◆ Should have an accumulator
 - ◆ System should include a full function brake system with parking brake operation

1.1.8. Tricycle Landing Gear Trainer

The trainer should

- Be fully functional; with functioning components that simulate the workings of a typical light aircraft landing gear system
- Provide mechanisms for hands-on training
- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource preferably in accordance with regulatory body curriculum requirements (FAA, EASA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (has castors)
- Be fitted with actual aircraft parts that include tires, tubes, wheels, dual and single-disc brakes, nose-wheel steering mechanism, brake pedals, dual brake-fluid reservoirs, master cylinders and hydraulic plumbing for the brakes.
- Be used for the following tasks
 - ◆ Inspection and maintenance of nose wheel steering mechanism
 - ◆ Shock strut inspection and maintenance
 - ◆ Shock strut disassembly and reassembly, and Hydraulic brakes inspection and maintenance
- Have a cutaway shock strut to expose the internal mechanism for demonstration and functional description of the strut
- Is fitted with an actuator for retraction and extension operation
- Be easily maintainable with accessible spare

1.1.9. Oxygen System Trainer model

The trainer should

- Be fully functional; with functioning components that simulate the workings of oxygen system
- Provide mechanisms for hands-on training

- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource preferably in accordance with regulatory body curriculum requirements (FAA, EASA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (has castors)
- Meet regulatory requirements
- Have the following components
 - ◆ Oxygen Cylinder
 - ◆ Pressure Regulator
 - ◆ Filler Valve
 - ◆ Control Valve
 - ◆ Pilots’ Oxygen Mask
 - ◆ Passenger’s Portable Mask
 - ◆ Passenger Drop-down masks
 - ◆ All necessary plumbing and fittings
 - ◆ Easily rechargeable bottle
 - ◆ Component which show chemical oxygen generation system
 - ◆ With accessories and available oxygen generating chemicals
- At least have the following systems
 - ◆ Crew Oxygen System
 - ◆ Passenger Oxygen System
 - ◆ System Controls and Indications
 - ◆ Drop-down mask system
- Storage cylinder should be of an approved type
- Be easily maintainable with accessible spare

1.1.10. Aircraft Pneumatic System Trainer

The trainer should

- Be fully functional; with functioning components that simulate the workings of aircraft pneumatic system
- Provide mechanisms for hands-on training
- Use actual aircraft system components
- Have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource preferably in accordance with regulatory body curriculum requirements (FAA, EASA)
- Preferably include a CBT which covers the system description and components’ details and can be used in the company’s Local Area Network
- Be supported on a durable frame which can easily be moved (has castors)
- Represent a pneumatic system that is used as an emergency backup for hydraulic system
- Typically demonstrate emergency braking system in case of hydraulically actuated brake failure
- Use a reservoir that can be refilled after use from any pressurized air source like shop air or air compressor commonly found in AMT schools
- have the typical pneumatic system components like Shut-off valve, Relief valve, Moisture separator, Pneumatic filter, check valve, Shuttle valve, Emergency supply valve, Pressure reducing valve, Pressure gauge, Emergency air bottle, Selector valve, Pneumatic actuator, All necessary fittings and plumbing
- Be easily maintainable with accessible spare

1.2. Test benches

1.2.1. Hydraulic and Pneumatic test bench

The test bench should

- Test a wide range of Pneumatic and hydraulic aircraft system components
- Have documentation such as system diagram, user manual, operation manuals for both systems
- Test pneumatic and hydraulic units
- With electrical power
- With Hand pump
- Preferably have provisions to test fuel components
- Test (Actuators, Valves, oil coolers, accumulators, hoses tubes and fittings, pumps and motors)
- Have (fluid Pump, Pressure Gauges, Accumulator, Fluid Reservoir, System filter, Control Valves)
- Work with skydrol and shop Pneumatic Air source
- Low to high pressure capacity (0-3000 psi)
- Power supply 220v 50/60 hz 3 phase
- Accurate, minimum maintenance required

1.3. Typical aircraft system schematic posters

- System diagram should show major systems for 737 NG aircraft.
- Diagrams should be in full color.
- Depict systems in a clear, easy, concise and logical manner so that they are easy to understand and provide a quick overview of each system.
- Diagram should be of adequate size to be posted on classroom walls (36" x 48")
- Poster Material should be a white opaque polyester film with a super-glossy white finish.
- Must be laminated and framed

- Quantity and description of posters must be as shown in the following table

No	Aircraft type	System/ ATA	Qty.
1	B737 NG	Hydraulic system	6
		Flight control system	6
		Landing gear system	6
		Fuel system	6
		Air conditioning system	6
		Water and waste system	3
		Ice & Rain	3
		Oxygen system	3
2	Q400	All ATA (systems, Cockpit, Synoptic Page) Posters.	2 from each
3	B777	All ATA (systems, Cockpit, Synoptic Page) Posters.	2 from each
4	B787	All ATA (systems, Cockpit, Synoptic Page) Posters.	2 from each
5	A350 - 900	All ATA (systems, Cockpit, Synoptic Page) Posters.	2 from each

2. Powerplant

2.1. Propellers and engine cutaways/Trainer

2.1.1. Hamilton standard 22D30 propellers

The trainer should

- have maintenance manual and overhaul manual
- have complete and cut away unit propellers

- Allow propeller servicing
- have CBT depicting assembly and disassembly and removal and installation; CBT must be used on Local area network of the company
- have propeller assembly balancing equipment
- have Adjustable engine work stand with castor and locking feature
- **All toolkits necessary for maintenance activities**

2.1.2. JT8D Cutaway

The trainer should have the followings:

- non runnable cutaway engine
- a cross section against outer ducts, the outer surface of inner ducts and bearing operation of fan discharge section
- cross section against all stages and bearing operation of a turbine section
- cross section against all stages and bearing operation of a compressor section
- starter motor to demonstrate phased operation of compressor turbine assembly
- complete cross section of pipe lines for fuel system, oil system and pneumatic system to demonstrate flow operation
- cross section against engine core cooling system
- cross section against turbine clearance control system
- cross section against gearbox to engine attachment area
- cross section against gearbox section of the engine
- runnable engine

2.1.3. PT6A cutaway

The trainer should have

- Non runnable cutaway engine

- cross section against all stages and bearing operation of a compressor section
- starter motor to demonstrate phased operation of compressor turbine assembly
- complete cross section of pipe lines for fuel system, oil system and pneumatic system to demonstrate flow operation
- cross section against bearing seals such as carbon seal and labyrinth seal
- cross section against turbine clearance control system
- cross section against gearbox to engine attachment area

2.1.4. Aircraft Turboprop Engine Trainer

The trainer should have the following features:

- Pratt & Whitney PT6A Standard
- With an Exhaust Outlets
- Hartzell 3 blade constant speed full feathering reversing propeller
- Complete engine electrical system including Starter system, ignition leads, ignition unit, plugs, and battery
- Provide All the necessary engine monitoring instruments as follows:
 - N1 and Prop Tach Indicators
 - Oil Pressure Gauge
 - Oil Temperature Gauge
 - Fuel Pressure Gauge
 - Fuel Flow Indicator
 - Torque Pressure Indicator
 - ITT Indicator
 - Fuel Quantity Gauge
 - Voltmeter
 - Ammeter
- Throttle Control, Fuel Setting, and Propeller Control Levers

- instruments and controls are housed in a semi-enclosed protective cabin
- Prop Governor, N1 and Prop Tach Generators, Starter-Generator and others
- User manual, training manual, and computer based training (CBT) courseware.
- **All tools necessary for maintenance**
- Equipped with Safety features

2.1.5. Thrust Reverser System Trainer

The trainer should have:

- Complete Thrust Reverser System
- Control Throttle with reverse thrust gate
- System Control Panel
- System Arming Indicator
- MLG Air/Ground Sensor
- Fire Warning Switch
- Oil Pressure Sensor
- Safety Cage
- Durable, sturdy steel frame with swivel caster wheels & brakes
- Power Supply (requires 110V AC or 220V AC input)
- User manual, training manual, and computer based training (CBT) courseware.

2.1.6. Mini Lab Gas Turbine engineering teaching system

The trainer should have

- an operating manual
- Classroom/Lab workbook
- Service and maintenance manual
- ELECTRICAL SERVICE: 120/240 VAC, Single Phase, 50/60 Hz, 20 Amps Breaker Protected

- use fuel: Jet A, A-1, B; JP-4, 5, 8; Kerosene, Diesel, Fuel Oil #1 or #2
- MIL-PRF-23699F-STD (aeroshell 500, BP/Exxon 2380)
- ADEQUATE VENTILATION: Air Intake, Exit and Combustion Gases
- ADEQUATE CLEARANCE to allow operator access to all four sides of unit RECOMMENDED minimum 60 inches (152 cm) on all sides.
- A fire extinguisher
- Other safety related system
- manual teaching resources; Engine maintenance manual, IPC and instructor's Resource CD
- CBT on the teaching system; CBT must be used on Local area network of the company
- Equipped with redundant operational safety features

2.2. CBT (Computer based training)

2.2.1. EASA 66 CBT COURSEWARE (MODULE 1 UPTO MODULE 17)

The CBT courseware should include the following topics:

- Mathematics
- Physics
- Electrical Fundamentals
- Electronic Fundamentals
- Digital techniques/Electronics instrument
- Materials and Hardware
- Maintenance practices
- Basic aerodynamics
- Human Factors
- Aviation Legislation
- Turbine airplane aerodynamics, structures and systems

- Helicopter aerodynamics, structures and systems
- Piston airplane aerodynamics, structures and systems
- Aircraft aerodynamics, structures and systems
- Propulsion
- Gas turbine Engine
- Piston Engine
- Propeller
- specific maintenance task procedures as applicable
- operational test procedures as applicable
- Functional test procedures as applicable
- Safety procedures as applicable

3. Aircraft Battery charger and analyzer (quantity-1)

- 3.1 The charger should offers a wide selection of charging techniques for servicing and reconditioning NiCad, lithium ion, vented lead-acid, and sealed lead-acid batteries exactly as recommend by the battery manufactured.
- 3.2 The charger can charge two batteries at maximum current and it can also discharge two batteries at reduced current.
- 3.3 The charger should be dependable, 100% solid state circuitry and only requires yearly calibration.
- 3.4 The charger should be capable of constant potential charge all 6, 12, 24 and 28 volt vented or sealed lead-acid batteries.
- 3.5 The charger should be capable of constant current charge Nickel cadmium batteries up to 24 cells, as well as charging individual cells, or groups of cells.
- 3.6 The charger should have peak charging capability.
- 3.7 The charging rate and time in the constant current mode should be adjustable.
- 3.8 The charger should be capable of two-Step Constant Current, can provide a high charge rate for a certain period of time, and then drop to a lower charge rate for an equal charge period.

- 3.9 The charger should be capable of negative slope sensing, when charging causes the temperature of NiCad batteries to rise, the voltage of the batteries diminishes, which can result in further heating. As a safety feature, the charger employs negative slope sensing of the charge curve to detect over-charging, and halt possible thermal runaway of the battery.
- 3.10 The charger should be capable of Short, Long, and Deep Cycles.
- 3.11 During the short cycle, the battery is discharged based on criteria established by the operator. If the battery drops below a minimum acceptable voltage level before the end of the preprogrammed period, there should be “Battery Reject” light illuminates.
- 3.12 The charger should be capable of Voltage/Current monitored any point in the process, from initial adjustment of the charge, or discharge, current through completion of the charge, discharge, or recharge stages.
- 3.13 The charger should have Cell-By-Cell testing, front panel jacks allow a pair of test probes to be connected and capable of individual battery cells or groups of cells voltage check.
- 3.14 The charger should have wait state, can be programmed to introduce a wait state after the discharge portion of the analysis, allowing the battery to cool before automatic recharge takes place.
- 3.15 The charger should design to sense battery over voltage and over temperature.
- 3.16 In the event of failure the charger should alert the operator visually and audible tone.
- 3.17 The charger should have discharge current up to 60 amps, charge current 0 to 50 amps, automatic main to topping, and service 1 or 2 batteries at a time, digital meters and input for external leads for individual cell measurements.
- 3.18 The charger should be capable of reverse polarity, short circuit and open circuit protection,
- 3.19 The charger should have
Charge: SCR controlled 50 AMPS maximum.

Discharge: transistor controlled 60 amps maximum. Timer: 1 to 9 hours for main charge and 1 to 60 hours for total.
Line input voltage 220vac, at 50 to 60 Hz.

4. Aircraft batteries (quantity-2)

- 4.1 Nickel-cadmium type with sintered plate construction, and uses potassium hydroxide electrolyte
- 4.2 It should consist a case and cover, 20 cell assemblies, and a temperature sensor assembly.
- 4.3 The temperature sensor assembly includes a thermos switch mounted on a plate and a charge control thermistor. The temperature sensor should be capable of cutting off charging if the battery temperature exceeds a safe operating limit.
- 4.4 The battery should have voltage Nominal 24 volts, open circuit voltage, fully charged 26+/- 1 volts, number of cell assemblies 20, rated capacity 40AH, venting pressure 2 to 10 psi, cell assembly case material stainless and electrolyte potassium hydroxide.

5. Battery Tool Kit Standard (quantity-2)

- 5.1 A special tool kit

Including:

- ✓ Equalizing resistors (1 Ohm / 3W)
- ✓ Syringe
- ✓ Cell extraction wrench (M8 / M10)
- ✓ Universal vent wrench
- ✓ Nozzle 12 mm
- ✓ Nozzle 15 mm
- ✓ Nozzle 20 mm
- ✓ Nozzle 20 mm (for MS valves)
- ✓ Nozzle 24 mm
- ✓ Nozzle 33 mm
- ✓ Nozzle 38 mm
- ✓ Wrench M18 for Connector
- ✓ Wrench M22 for Connector

6. Connector: Battery, Quick Disconnect (quantity-4)

6.1 Capable of quick connecting and disconnecting

7. Aircraft Basic Electricity Panel (quantity-4)

7.1 It should be designed to provide practical hands-on instruction in introductory electrical circuits.

7.2 The unit should be built used by an individual student at a bench top work station.

7.3 The unit should be mounted on a custom built work cabinet and contains ammeter, voltmeter, relays, switches, circuit breakers, and other basic components.

7.4 It should have an instructor and student training manuals included.

7.5 It should have an instructor's panel allows system faults for training in troubleshooting and repair

8. Aircraft Electrical System Trainer (quantity-1)

8.1 The aircraft electrical system trainer should be an ideal resource to teach about an aircraft multiengine electrical system.

8.2 The trainer should teach the functionality of each component, and also develop logical and systematic approach to perform troubleshooting tasks.

8.3 The system is laid out to depict a typical aircraft electrical system, and should contain standard aircraft components and wiring.

8.4 The trainer should have a complete functional simulation of a dual-engine 28V DC electrical system of a typical turbine aircraft.

8.5 Trainer should have been designed to teach the students parallel generator bus configuration, split bus configuration and ring buses. Instructor can able to switch the main bus configuration.

8.6 System should have the following features

- ✓ Two Independently Driven 28V DC Generators
- ✓ Two Interconnected Generator Control Units
- ✓ Switchable main buses configuration between Split Bus System and Parallel Bus System (DG models only)

- ✓ Avionics Relay and avionics bus
- ✓ Two solid-state Generator Control Units (GCU)
- ✓ Typical Cockpit Instrumentation, Circuit Breakers, and Controls
- ✓ Representative Loads
- ✓ Two Main Bus-bars for each generator
- ✓ Two Auxiliary Bus-bars
- ✓ Battery Bus-bar
- ✓ Two 115 V @ 400 Hz Bus-bars
- ✓ Two 26 V @ 400 Hz Bus-bars
- ✓ Parts used are aircraft components
- ✓ Battery charging system
- ✓ Faults incorporated by instructor to teach troubleshooting techniques
- ✓ Voltmeters (two) and Ammeters (three)
- ✓ Distribution terminal strips (six)
- ✓ Instructor’s manual & Students’ manual with wiring diagrams
- ✓ Computer-based Training (optional)
- ✓ APU Input Plug (one)
- ✓ Dual Solid State Inverters to produce 115 VAC @ 400 Hz and 26VAC @ 400 Hz
- ✓ Low noise enclosure for generators
- ✓ Comprehensive safety features, e.g. emergency shutdown

8.7 Specifications:

Battery: Aircraft sealed, 24V battery

Generator: Aircraft DC generator rated 28VD

@40A/50A at 3600 rpm, driven by 230 VAC/50 Hz motor.

Generator Controls:

Electronic Controlled Generator Build-up

Electronic Field Controller/Switching

Current Limiter

Reverse Current Protection

Paralleling / Equalizing

GCU induced Over Voltage (OV) Protected

Voltage Regulation: 28.4V + 0.4V

Max Field Current: 3A.

Starters: Aircraft Starter 24 VDC

AC Power:

Two Static Inverters, two Generator Bus-bar

Two Auxiliary Bus-bars Battery Bus-bar

Ground Bus-bar

Power Distribution:

Two bus-bars 115VAC @ 400 Hz

Two bus-bars 26VAC @ 400 Hz

Two AC Neutral Bus-bars

Avionics bus-bar

Electromechanical Loads:

Landing Gear Motor

Cabin Air Blower

Avionics Blower

Electromechanical Actuator

External Lights:

Navigation Lights (Right Wing, Left Wing, Tail)

Strobes (Right Wing, Left Wing, Tail)

Rotating Beacon

Landing/Taxi Light

Internal Lights:

Cabin Light

Reading Light

Multifunction Cockpit Light with Dimmer

Stall Warning System (SWS):

Leading Edge Sensor (Vane type)

Audio Warning Horn

Independent Battery for SWS

Instruments:

No.1 Generator Voltmeter

No.1 Generator Ammeter

No.1 Generator Hour meter

No.2 Generator Voltmeter

No.2 Generator Ammeter

No.2 Generator Hour meter

Battery Ammeter

Fuel Gauge

8.8 Wiring:

The trainer should have aircraft wires, with clear identification labels for each wire. All wires should be coded and labeled for troubleshooting. It should demonstrate aircraft standard wiring practices

8.9 The trainer should have electrical controls like mains AC circuit breakers, manual switch, and starter switch.

8.10 The trainer should have instructor’s panel with capability of fault insertion.

8.11 The trainer should have indicators like master power indicator, generator status indicators, inverter status indicators, bus configuration indicator

8.12 The trainer should incorporate warnings for Generator out, stall warning system aural warnings

8.13 The trainer should have User’s Manual, Study Guide, Instructor’s Guide and Computer-Based Training.

8.14 The trainer should have safety protection, ventilation and sound proofing.

9. Soldering iron (quantity-12) and soldering sucker (quantity-12)

9.1 The soldering iron should ideal for a wide variety of electronic tasks.

9.2 The soldering iron should have interchangeable heater elements and quick change knurled collar makes changing heater simple.

9.3 The soldering iron should be small lightweight handle with cushioned grip.

9.4 The soldering iron should have operating power 25W, 220VAC.

9.5 The soldering iron should be temperature controlled and there should be a display for it.

9.6 Pencil thin soldering iron

9.7 De-soldering pump that is one hand operation with spring-loaded piston provides ESD-safe vacuum that removes solder. Self-cleaning, non-clogging, static-free replaceable tip

10. Electrostatic discharge (ESD) mat with wrist strap (quantity-12)

- 10.1 It should protect sensitive equipment from static damage.
- 10.2 Wrist ground cords with banana plugs.
- 10.3 A wrist strap with highest quality static material to ensure static dissipation and easy to wear

11. Fire detection and extinguishing Trainer (quantity-1)

- 11.1 The system should provide a hands-on training of a functional unit of a typical fire detection and extinguishing system
- 11.2 Uses actual aircraft system components
- 11.3 Should have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource in accordance with EASA requirements
- 11.4 Preferably includes a CBT which covers the system description and components’ details
- 11.5 Should be mounted on a vertical panel supported on a durable frame which can easily be moved (have castors)
- 11.6 Must meet regulatory requirements
- 11.7 Should at least have the following features
 - Control unit
 - Loop detector
 - Fenwall spot detector
 - Electromech guarded and unguarded switches and lights
 - Resetable Discharge Indicator
 - Smoke Detection System
 - Fenwall spot detector sensor hybrid into the fire detection alarm system.
 - Fire warning lights
 - Fire warning horn with latching horn-silencing relay switch-found on large transports
 - Continuous-loop temperature sensor and control box
 - All electrical wires marked with ATA codes corresponding to the electrical schematics provided.

- Same alarm system as found in all single-engine through four-engine transports
- Press-to-test illuminated switch wired to reset the system after discharge
- Guarded “fire extinguish discharge” illuminated switch
- Fire extinguisher bottle pressure gauge should be wired into the system giving a simulated bottle pressure; full or empty indication should be dependent upon system condition should include automatic reset.

12. Fiber Optic Experiment Card (quantity-12)

- 12.1 The Fiber Optic experiment card should be designed to give students the skills and knowledge to identify and repair fiber optic cables, connectors and systems.
- 12.2 The theoretical section must teach the principles of light, signal & signal loss, fiber optic components and fiber optics systems.
- 12.3 The hands-on section must teach student to fiber optics cable construction, connectorization and troubleshooting.
- 12.4 The card should consists
- ✓ Photoelectric Transducers
 - ✓ Fiber Optic Transmitter
 - ✓ Fiber Optic Receiver
 - ✓ Audio Driver
 - ✓ Time Division Multiplexer
 - ✓ Time Division Demultiplexer
 - ✓ Quad Tone Generator
 - ✓ Digital Signal Source
- 12.5 The card should include the required connector.
- 12.6 The card should include fiber optic polishing kit.

13. ARINC 429 Digital Data Buss System(quantity-1)

- 13.1 The trainer should allow the demonstration and testing of simple and complex send and receive functions over an ARINC 429 digital data buses.

- 13.2 The trainer should demonstrate send only, receive only, bi-directional control, data transmission, position and warning functions all incorporated into the system.
- 13.3 Components like cargo door and OAT sensor, rotating beacon and an actuator with limit switches included.
- 13.4 The components preferred to be mounted on a metal roll-around work station.
- 13.5 The unit should be powered by 220V AC.
- 13.6 The unit should have documentation such as system diagram, user manual, student’s study guide, instructor’s teaching resource.
- 13.7 The trainer should have instructor’s panel with capability of fault insertion.

14. 8051 micro-controller experiment card (quantity-12)

- 14.1 The 8051 Micro-controller experiment card set Should describes the internal structure, timed operations, external timing & control connections, memory connections and the connection of input/output devices.
- 14.2 The students should interface with the 8051 by entering a simple program, observing various signals generated by the 8051, the operation of external memory and signals of the keypad circuitry in the microcontroller system.
- 14.3 The 8051 Micro-controller must consist 8 Bit Controller, Keyboard/Display and I/O and Interface.

15. Aircraft electronic systems (quantity-12)

- 15.1 The aircraft electronic systems should introduce aircraft instrument systems and aircraft communications systems.
- 15.2 This topics should be include tachometer, torque, & position-indicating systems, temperature & fuel flow indicating systems, pressure sensing & chip detection systems, aircraft master warning & annunciator systems, and aircraft antenna systems.
- 15.3 The system should have a hands-on troubleshooting experiment using standard test equipment.

16. EFIS/EICAS Trainer (quantity-1)

- 16.1 The trainer should be panel-mount LCD flight and navigation displays.
- 16.2 The trainer must have a full functional primary flight display (PFD) for attitude/directional guidance with electronic engine monitoring and detailed moving-map multifunction display (MFD) capabilities.
- 16.3 There should be separate PFD and MFD screens, with full reversionary backup for redundancy.
- 16.4 The trainer must be designed to integrate pilot/aircraft interaction into one central system.
- 16.5 The system must combines primary flight instrumentation, aircraft systems instrumentation, engine instrumentation, warnings/alerts, and navigational information, all displayed on two LCD color screens.
- 16.6 The trainer should have a complete package that represents EFIS / EMS / EICAS displaying flight instrumentation, position, navigation, communication, and identification information to the pilot using dual 7” wide (800x480) flat-panel color displays.
- 16.7 It should use a sophisticated graphics model; the integrated synthetic vision technology provides the perspective of what lies ahead. The system must pull together information from the built-in aviation base map and terrain elevation database. By adding an optional Mode S transponder, the system can display Traffic Information Service (TIS) alerts.
- 16.8 The system can also be coupled with autopilot system to provide sophisticated flight control modes including altitude preselect and capture, heading hold and GPS as well as ILS navigation.
- 16.9 It should use GPS-aided digital ADAHRS (Air Data and Attitude Heading and Reference Systems) with solid-state sensors and sophisticated attitude determination and integrity monitoring algorithms used in high-end systems.
- 16.10 All wirings and connectors must be as per the approved and acceptable standards for aircraft wiring.
- 16.11 The trainer should have the following units:

- ✓ Air Data Computer (ADC),
- ✓ Engine/Airframe Unit
- ✓ Attitude and Heading Reference System (AHRS).
- ✓ Outside air temperature (OAT) probe
- ✓ Magnetometer
- ✓ Air Data Sensors: Airspeed, Altitude, OAT
- ✓ Engine Sensors:
 - x CHT
 - x EGT
 - Oil Temperature
 - Oil Pressure
 - Fuel Flow
 - Fuel Quantity
 - Manifold Pressure
 - Ammeter Shunt
 - Engine RPM
- ✓ Airframe Sensor Inputs:
 - Pitch Trim
 - Roll Trim
 - Flap Position
 - Speed Brake
 - Aircraft Main Door
 - Aircraft Alternate Door
 - Baggage Door
- ✓ Avionics Interfaces:
 - GPS
 - Transponder
 - Autopilot
 - NAV/Comm
- ✓ Power: 220V AC at 60/50 Hz, single phase
- ✓ Documents:
 - User Manual
 - Students Study Guide
 - Computer Based Training (CBT):

17. Cockpit instrumentation system (quantity-1)

- 17.1 It should be a functional simulation of a standard aircraft cockpit. It has to include basic flight and engine instrumentation.
- 17.2 It can also be used to demonstrate the functioning of gyros, altimeters and the standard engine instruments. All of the systems should be completely plumbed and functional.
- 17.3 It should have the following features
- ✓ Functional pitot static system
 - ✓ Function gyros and basic flight instruments
 - ✓ Tilt/swivel-mounted instrument panel for full demonstration of gyro function
 - ✓ Functional engine instruments controlled by throttle
 - ✓ Instructor’s fault panel
- 17.4 It should have the following components
- ✓ Directional gyro
 - ✓ Attitude indicator
 - ✓ Airspeed indicator
 - ✓ Turn and bank indicator
 - ✓ Altimeter
 - ✓ Rate-of-climb indicator
 - ✓ Engine tachometer
 - ✓ Manifold pressure gauge
 - ✓ Oil temperature indicator
 - ✓ Vacuum indicator
 - ✓ Vacuum filter/pump
 - ✓ Vacuum pressure regulator
 - ✓ Tach generator
 - ✓ Oil temperature sensor
 - ✓ Pitot-static system, including:
 - ✓ Pitot tube
 - ✓ Fuselage side static port
 - ✓ Alternate static source
 - ✓ Static source selector
- 17.5 Operating power: 220vac at 50/60 HZ single phase

18. Basic transducers experiment card (quantity-12)

- 18.1 The courseware should be designed to provide students with a solid foundation in the theory and operation of light, heat, motion, and position and sound transducers.
- 18.2 The lessons should combine practical concepts and with hands-on experimentation.
- 18.3 Students completing the courseware should possess a fundamental knowledge of transducer theory and the skills to successfully troubleshoot, align and repair transducer systems.
- 18.4 It should consist of
 - ✓ Photoelectric Transducers
 - ✓ Temperature Transducers
 - ✓ Photoelectric Motion
 - ✓ Sensing
 - ✓ Photoelectric Position Sensing I

19. Servo/synchro trainer system (quantity-1)

- 19.1 Synchro-Servo Training System should be a portable, self-contained, educational system. Its modular design must allow the student to observe and analyze the fundamental components of the servo system and associated electronic circuits.
- 19.2 The system should allow students to build synchro-servo systems of their own by interconnecting components.
- 19.3 The system should provide a basic understanding of operational theory, as well as the ability to analyze, troubleshoot, and demonstrate open- and closed-loop synchro-servo systems.
- 19.4 System interconnections, operating signal states, trouble symptoms, and zeroing errors should be easily conveyed and identified through the use of front panel interconnection jacks and stacking leads.
- 19.5 The front panels must be clearly silk-screened with standard electrical and servo-mechanism symbols, representing each module's function.
- 19.6 It should be operated on low voltages from the power supply, which is built into the system enclosure. When the control modules are inserted into the enclosure, they are

automatically energized (provided that the main power switch is on).

- 19.7 Solid state amplifier modules provide signal amplification, phase shift, and power gain typically required in practical systems.
- 19.8 The system enclosure, with built-in back-panel connectors, accepts control modules and synchro-servo modules.
- 19.9 The system should have a fault-insertion capability that introduces common system or component malfunctions.
- 19.10 The synchro-servo modules can be mechanically coupled to a load by a timing belt.
- 19.11 The trainer should consist
 - ✓ Power supply
 - ✓ Error detectors
 - ✓ Potentiometers
 - ✓ Modulator / demodulator
 - ✓ Phase shifter / power amplifier
 - ✓ Capacitor
 - ✓ Signal amplifiers
 - ✓ Synchro transmitter (TX)
 - ✓ Synchro control transmitter (CX)
 - ✓ Synchro receiver (TR)
 - ✓ Synchro differential transmitter (TDX)
 - ✓ DC servo motor / dc tacho-generator
 - ✓ AC servo motor / asynchronous
 - ✓ Tacho-generator
 - ✓ Inertia/friction load
- 19.12 Power Supply at 220vac, 50/60HZ

20. Autopilot trainer (quantity-1)

- 20.1 Autopilot/ Automatic Flight Controls Trainer should be a resource for teaching the principles of automatic flight controls by demonstration using a complete system that encompasses all the aspects of autopilot and automatic flight controls.
- 20.2 The Trainer should consist of three axes flight control computer, Mode Controller, Mode Annunciator, Pitch / Yaw / Roll servos, Flight Director, and a magnetic slaved HSI System integrated with cockpit controls and includes control linkages to the control surfaces of a model aircraft.

- 20.3 The trainer, in the standard configuration should consist of a large model airplane with all the main control surfaces (rudder, elevator, aileron and trim).
- 20.4 The trainer should be equipped with a complete control mechanism linked to a control yoke and rudder pedals. Any movement in control yoke and rudder pedals results in the proportional movement of the control surfaces.
- 20.5 The system may be interfaced with a compatible EFIS system and will accept inputs from a variety of navigation equipment.
- 20.6 The autopilot equipment used in the trainer should borrow technology from the flight control systems developed for high-end business jets and commercial aircraft.
- 20.7 The simplicity of design and ease-of-use gives instructors and AMT trainees an ideal teaching and hands-on learning resource to fully explore all the features of an advanced autopilot system.
- 20.8 Specifications:

Equipment and LRUs

- ✓ Remote-mounted, magnetic slaved Directional Gyro
- ✓ Flight Computer
- ✓ Magnetic Slaving Transmitter
- ✓ Roll Servo
- ✓ Yaw Servo
- ✓ Pitch servo
- ✓ Pitch Trim Servo
- ✓ Vacuum Pump
- ✓ Avionics Blower

Instrument Panel

- ✓ Flight Director
- ✓ Horizontal Situation Indicator
- ✓ Mode selector
- ✓ Yaw Mode Selector
- ✓ Slaving Control
- ✓ Aural warning Horn

Controls

- ✓ Control Yoke
- ✓ Two Rudder Pedals
- ✓ Circuit Breaker Panel
- ✓ Switch Panel
- ✓ Instructor’s panel for Fault Insertion

Documentation

- ✓ System Wiring Diagram
- ✓ Technical Manual
- ✓ User’s / Operating Manual
- ✓ Computer-based Training (CBT)

Power in put

- 220vac 50hz

21. **Electrical power, cables and connectors (quantity-16)**

21.1 Students should be introduced to Aircraft Wiring and Aircraft Power.

21.2 The various types of wires, cables, connectors, and tools must be covered theory then they have to build actual wire & cable assemblies and test the continuity of each.

21.3 Aircraft Power should covers batteries, DC & AC generation, basic aircraft & multi-engine aircraft power distribution systems each with a hands-on experiment emphasizing troubleshooting.

22. **The Aircraft Electrical Systems (quantity-12)**

22.1 Students should be introduced to Aircraft Airframe Systems and aircraft Engine Systems.

22.2 The following systems should be covered; Aircraft Lighting, Aircraft Ice & Rain Protection, Environmental Control, Landing Gear, Aircraft Braking, Fire Warning & Extinguishing, Aircraft Fuel, and Aircraft Ignition.

22.3 Students should be first taught the theory of each then apply each with a hands-on troubleshooting experiment using standard test equipment.

- 23. Aircraft Electronic flight instrument system (quantity-18)**
- 23.1 Students should be introduced to Aircraft Instrument Systems, aircraft navigation system and Aircraft Communications Systems.
- 23.2 These topics should be included Tachometer, Torque, & Position-Indicating Systems, Temperature & Fuel Flow Indicating Systems, Pressure Sensing & Chip Detection Systems, Aircraft Master Warning & Annunciator Systems, and Aircraft Antenna Systems.
- 23.3 Students should be first taught the theory of each then apply each with a hands-on troubleshooting experiment using standard test equipment.
- 24. 8085 microprocessor kit (quantity -12)**
- 24.1 Students should be introducing to the operation of microprocessors, the use and manipulation of binary numbers.
- ✓ Keypad and Display
 - ✓ Microprocessor I/O
 - ✓ Memory and Address
 - ✓ Decoder
 - ✓ 8085 Microprocessor
- 25. AC Industrial experiment card(quantity-12)**
- 25.1 The courseware should introduce the students to alternating current generation, sine waves and AC circuit components.
- 25.2 It should teach students to use AC test equipment on actual circuits and then reinforces AC theoretical concepts through experiments in inductance, capacitance, RL, RC, series and parallel RCL circuits and transformers. Additional topics include series and parallel resonance circuits, transients and RL filters.
- 26. Electrical cables and connectors (quantity-12)**
- 26.1 The Cables and Connectors program should provide an introduction to several common types of wire and cable, associated connector hardware, and the physical and

electrical checks required to verify the functionality of assembled cables.

- 26.2 Troubleshooting of wire and connector deficiencies should be stressed through simulations as well as actual cable continuity tests that utilize industry standard test equipment.
- 26.3 Practical exercises must require students to assemble various cables using the specific wires, connectors, and tools provided.
- 26.4 Consumables for 1 student.

Tools:

- ✓ Needle nose pliers
- ✓ Diagonal cutting pliers
- ✓ Cutter/Splicer
- ✓ Open barrel crimper D-Sub
- ✓ Crimper/Stripper
- ✓ Open barrel crimper F-Type
- ✓ Punch down
- ✓ Coaxial crimper
- ✓ Coaxial stripper
- ✓ Screwdriver

Connector types:

- ✓ 2 ea. - Coupler, fml, nylon insulated
- ✓ 2 ea. - Conn., butt slice, 22awg
- ✓ ea. - Housing, fml, 4 pos.
- ✓ 16 ea. - Terminal, fml
- ✓ ea. - Conn. jack, telephone, 4 pos.
- ✓ 11 ea. - Conn., RJ45, 8 pos., unkeyed
- ✓ 3 ea. - Conn., RJ45, Cat 5, EIA 568A
- ✓ 2 ea. - Conn., 9 pin, D-sub, receptacle
- ✓ 2 ea. - Conn., 9 pin, D-sub, plug
- ✓ 18 ea. - Pin, crimp, male, D-sub, 20awg
- ✓ 18 ea. - Pin, crimp, fml, D-sub, 20awg
- ✓ 4 ea. - Cover, 9 pin, D-sub
- ✓ 4 ea. - Conn., BNC, male, cable mnt
- ✓ 4 ea. - Conn., BNC, fml, cable mnt

Wire and Cable types:

- ✓ 4 ea. - Wire, 8”, 22awg, red
- ✓ 2 ea. - Wire, 8”, 22awg, black
- ✓ 2 ea. - Wire, 8”, 22awg, blue
- ✓ 4 ea. - Wire, 8”, 22awg, yellow
- ✓ 2 ea. - Cable, 14”, 4 cond., flat, satin
- ✓ 2 ea. - Cable, 14”, 8 cond., flat, satin
- ✓ 3 ea. - Cable, 14”, 4 pair, Cat 5, twisted
- ✓ 1 ea. - Cable, 32”, 4 pair, Cat 5, twisted
- ✓ 2 ea. -Cable, 14”, 9 Cond.
- ✓ 2 ea. - Cable, 14”, coax, RG58
- ✓ 2 ea. - Cable, 14”, coax, RG59

27. Soldering model (quantity- 200)

- 27.1 The circuit card should provides a comprehensive course on Soldering Safety and Electrostatic Sensitive Devices, Solder and Soldering Equipment, Wire Stripping, Tinning, and Splicing, Terminal Types and Connections, PCB Types and Manufacturing Methods,
- 27.2 Through-Hole Non-Polarized Component Soldering and De-soldering, Through-Hole Polarized Component Soldering, Soldering Surface Mount Devices, and Coax Cable Connectors.
- 27.3 This program should be project based with hands-on preparing, repairing, mounting, soldering, and de-soldering components onto a PCB along with assembling BNC connectors and attaching to coaxial cables.

Consumable Components

- ✓ 1 ea. – Solder Project PC Board
- ✓ 1 ea. – Capacitor, Tantalum, 1 μ F, 35V
- ✓ 1 ea. – Capacitor, Tantalum, Solid, 10 μ F, 16V
- ✓ 2 ea. – Capacitor, Ceramic, Mini, .1 μ F, 50V
- ✓ 1 ea. – Diode, 1N4003, 200V, Rectifier
- ✓ 1 ea. – Diode, 1N4148, Signal
- ✓ 1 ea. – Dummy, Transistor, TO18
- ✓ 4 ea. – Resistor, Carbon Film, 100 Ω , 5%, 1/4W
- ✓ 1 ea. – Dummy, Resistor, Surface Mount, 2512
- ✓ 1 ea. – Resistor, Potentiometer, Ceramic, PC, 1K

- ✓ 1 ea. – Dummy, IC, 20 Pin, Through Hole
- ✓ 1 ea. – Dummy, IC, 20 Pin, Surface Mount
- ✓ 5 ea. – Terminal, Bifurcated
- ✓ 5 ea. – Terminal, Turret
- ✓ 5 ea. – Terminal, Hook
- ✓ 5 ea. – Terminal, Pierced
- ✓ 5 ea. – Terminal, Cup
- ✓ 10 ft. – Wire, Red/White, 22 AWG
- ✓ 1 ft. – Cable, RG58A/U, Stranded Core
- ✓ 1 ea. – Connector, BNC, UG-88C/U, Male, Plug, Clamp

28. Radio transmitter and receiver quantity (quantity-12)

- 28.1 Students should analyze and examine the operation of radio transmitter and receiver circuits.
- 28.2 Students observe the normal operation of a typical AM, SSB and FM system, and these tasks performed during a hands-on experiment along with identifying and troubleshooting faults.

29. Radar simulator assembly quantity (quantity-6)

- 29.1 The courseware should introduce the students to basic radar principles (weather radar) utilizing a hands-on approach.
- 29.2 The students should learn radar concepts and terminology and builds on that knowledge by examining a typical radar timing circuit, a sweep & video amplifier and typical radar characteristics.
- 29.3 The signals observed in the simulated radar must be nearly identical to a full scale operational aircraft weather radar system.

30. Semiconductor Devices (quantity-12)

- 30.1 The training module should provide theoretical concepts that are immediately reinforced by experiments.
- 30.2 Topics must include; semiconductor diodes, transistors, amplifiers, oscillators, multivibrator circuits and power supplies
- 30.3 Cards need to have the following features
 - ✓ Compatible with computer assisted instruction or traditional hard copy text materials.

- ✓ Pre-assembled circuits require no assembly, jumper wires, or soldering.
- ✓ Exposed components provide maximum technician accessibility
- ✓ Push-on, pull-off connections ensure self-cleaning of contacts.
- ✓ Powered automatically by computer instruction or manual push-button action.
- ✓ Nondestructive faults activated by computer instruction or manual push-button action.
- ✓ Generated signals are measurable with standard test equipment like digital multimeter , oscilloscope

30.4 The circuit cards must include

- ✓ Diodes
- ✓ Rectifier/Filter
- ✓ Bridge Rectifier/Filter
- ✓ Transistor Operation
- ✓ Transistor Bias
- ✓ Common Emitter
- ✓ Emitter Follower
- ✓ Common Base
- ✓ RC Coupled Amps
- ✓ Hartley Oscillator
- ✓ Astable Multivibrator
- ✓ Bistable Multivibrator
- ✓ Monostable Multivibrator
- ✓ FET Operation
- ✓ UJT Oscillator
- ✓ SCR Control Circuit,
- ✓ Transformer
- ✓ Power in put
- ✓ 20vac 50hz

31. Pressure measurement and calibration(quantity-1)

- 31.1 This unit should help students to study pressure measuring techniques and the modes of calibration of the relevant sensors.
- 31.2 Using a deadweight tester it should be enabling to generate pre-fixed pressures and to calibrate a Bourdon gauge and an electronic pressure sensor.
- 31.3 The tester should consist of a piston that can house a set of weights generating pressures up to 2 bars.
- 31.4 The sensor has to be pressure transmitter of piezo resistive type.
- 31.5 The unit should be able to give
 - ✓ Concept of pressure = force / area
 - ✓ Operation of a Bourdon gauge
 - ✓ Operation of a weight balance
 - ✓ Concepts of measurement and calibration
 - ✓ Absolute and relative pressure
 - ✓ Zero, full-scale and linearity errors
 - ✓ Calibration of a pressure gauge
 - ✓ Calibration of a pressure transmitter
- 31.6 Deadweight tester should be equipped with a set of weights being able to produce pressures up to 2 bars Bourdon gauge with transparent dial for showing the internal mechanism
- 31.7 Industrial pressure transmitter of piezo resistive type, with 4-20 mA output
- 31.8 Electrical console provided with display and calibration system with “zero” and “span”
- 31.9 Power in put 220vac 50hz

32. Portable Pressure Calibrator (quantity-1)

- 32.1 The calibrator should be intrinsically safe instrument which measure and display pneumatic and hydraulic pressure applied to the test port.
- 32.2 Pressure measurement should be absolute, gauge and sealed gauge and in ranges from 2.5 mbar to 700 bar (1.0 inH₂O to 10000 psi).

- 32.3 The Calibrator need to have pneumatic or hydraulic pressure generation components to produce pneumatic pressure ranges between -1 to 20 bar (-14.5 psi to 300 psi) and hydraulic pressure ranges up to 400 bar (6000 psi).
- 32.4 Using external multimeter the instrument should measure ± 30 volts d.c. and ± 55 mA.
- 32.5 The unit needs to have dual parameter display which shows the Input and Output values in large clear digits and needs to have shoulder strap which enables the instrument to be suspended for hands-free operation.
- 32.6 Power in put 220vac 50hz

33. Laser Gyroscope (quantity-1)

- 33.1 The educational kit should demonstrate to students the optical and mechanical components of a laser gyroscope as well as the practical work of alignment and measurement of such a system.
- 33.2 The gyroscope should be an active laser gyroscope and contains a ring laser consisting of an open frame He-Ne tube and a triangular resonator.
- 33.3 The whole ring laser should be set up on a motorized rotational platform. The rotational velocity can be varied allowing to the dynamic range of the Gyroscope to be investigated.
- 33.4 Counter-rotating modes of the ring laser should be coupled out and be superimposed for demonstration and measurement of the Sagnac effect.
- 33.5 The resulting interference should be detected and electronically converted to a frequency proportional to the rotational velocity and the output should be seen in by ordinary oscilloscope.
- 33.6 The unit needs to have the following
- ✓ Ring laser setup with HeNe laser tube, resonator mirrors, single mode etalon and detection unit
 - ✓ Amplifier and comparator for the detector signals
 - ✓ HeNe power supply
 - ✓ Rotation stage
 - ✓ Controller for the rotation stage with Joy-Stick
 - ✓ Adjustment laser for the resonator alignment

- ✓ Frequency counter
- ✓ Optics cleaning set
- ✓ User manual
- ✓ Power in put 220vac 50hz

34. Trainer (quantity-30)

For above items which requires a trainer

- 34.1 Console functions as the primary platform for electronic experiments performed in Computer Assisted Instruction (CAI) or text based curriculum.
- 34.2 The trainer must serves as a current limited power supply for printed circuit boards (experiment cards). Discrete voltages are used to activate the experiment cards allowing students to check, align, and troubleshoot operational electronic circuits using standard laboratory test equipment.
- 34.3 It must be fully automatic operation in CAI mode through student computer USB or serial port.
- 34.4 The trainer should have the following features
 - ✓ Supports automatic, manual, remote, and multiple fault insertion.
 - ✓ Built-in and auxiliary connections allow signal input/transfer between card positions.
 - ✓ Multifunctional bubble-press keypad controls for manual operation mode.
 - ✓ Automatic alarm sounds if malfunction is detected and display panel indicates symptom.
 - ✓ Built-in speaker for tone and radio signal recognition.
 - ✓ 20X4 character backlit liquid crystal display shows selected mode, keypad input signals, and trainer status.
 - ✓ Self-cleaning contacts to ensure a proper connection with each experiment card installation
 - ✓ Primary Power:
 - ✓ 220-240 VAC 50/60Hz (0.3A max), switched controlled & primary fuse protection

NOTE:

In relation to the above TECHNICAL SPECIFICATION requirements, the companies should provide the equipment's with the required connectors and accessories.

In relation to the above TECHNICAL SPECIFICATION requirements, even if the specification at each of the bid participating company does not 100% tally with ours, we advise each to offer what it has with the at most effort to meet our Technical requirement.