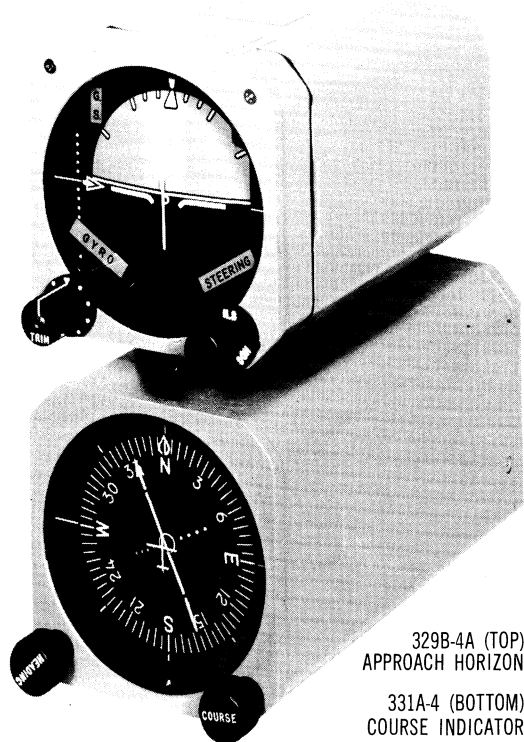




Pan American World Airways, Inc.

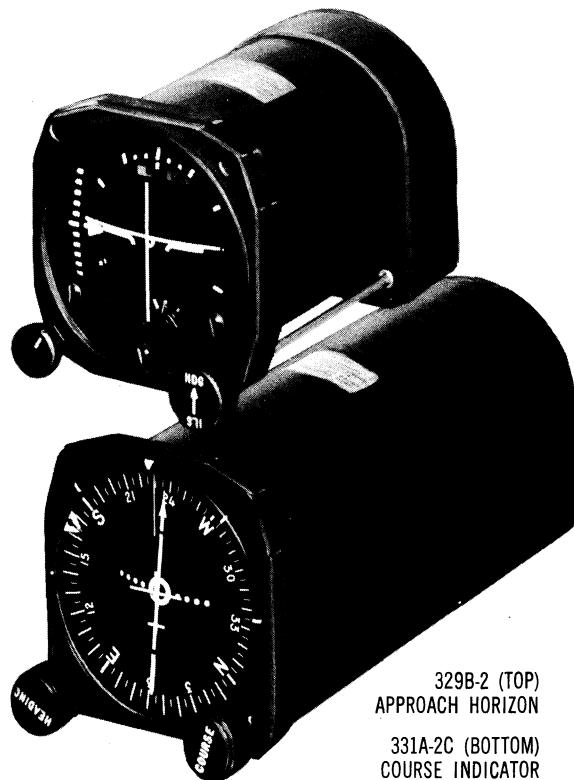
COLLINS aviation
equipment

FD-105 INSTRUMENTATION



329B-4A (TOP)
APPROACH HORIZON
331A-4 (BOTTOM)
COURSE INDICATOR

FD-104 INSTRUMENTATION



329B-2 (TOP)
APPROACH HORIZON
331A-2C (BOTTOM)
COURSE INDICATOR

Collins Integrated Flight Systems present basic attitude, navigation situation and steering information to the pilot on two easily interpreted, space-saving instruments. The systems, variations of which are available for all aircraft from light single engine to jet airliner, are used to control the aircraft attitude under instrument conditions, fly selected headings and VOR radials, and to make ILS approaches. Steering pointer indications enable the pilot to smoothly acquire and hold selected headings or localizer tracks. ILS crosswind correction is automatically presented by the steering pointer.

Aircraft attitude, glideslope position and steering directions appear on a "forward view" instrument, the Approach Horizon. The second instrument, the Course Indicator, displays the "plan view" or navigational picture of the flight. Included in this display are aircraft heading, selected heading, heading deviation, deviation from course, selected track crab angle and direction of travel along a selected omni radial. Once the navigational problem is set up on the Course Indicator, the pilot receives flight director steering information and can make good his desired flight path by keeping the steering pointer centered.

The Integrated Flight System — Automatic Pilot combination utilizes a single computer and common function, heading and track selector controls to provide simultaneous monitoring of the flight attitude and navigational situation as well as indication of the attitude and navigational corrections being

made by the Automatic Pilot. Approach Horizons have no mode selector switch when combined with Automatic Pilots.

FD-105 — Basic attitude information, navigation situation and flight director steering are presented on two 4" instruments. The FD-105 accepts signals from standard central data sources which also feed other systems. The Approach Horizon of the FD-105 has a two-color horizon background which further simulates the pilot's forward view of the flight.

Five large failure warning flags included in the integral wedge lighted instruments virtually eliminate the possibility of the pilot overlooking the failure of a central data source or some phase of the FD-105 system. Reliable magnetic amplifiers and transistors are used throughout; no vacuum tubes are required. All markings are matte white. Red or white lighting. *Power Requirements:* 115 v ac, 400 cps — start, 71 va; run, 58 va. A test set for the FD-105 is shown on page 25. *Approx. Weight:* 34 lbs.

FD-104 — The presentation is made on two standard 3" instruments designed for rear mounting. Accepts signals, excluding attitude, from standard central data sources as prescribed by ARINC. Instruments have matte white markings. *Power Requirements:* 115 v ac, 400 cps, single phase — start, 100 va; run, 50 va. 28 v dc — start, 30 watts; run, 10 watts. A test set for the FD-104 is shown on page 25. *Approx. Weight:* 35 lbs.

FD-107 — A lightweight flight director using FD-104 instruments along with a 562A-7 Steering Computer. Complete computer-amplifier is housed in a short ¼ ATR case. Accepts signals from standard central data sources prescribed by ARINC. *Power Requirements:* 115 v ac, 400 cps — start, 75 va; run, 50 va. 27.5 v dc — start, 30 watts; run, 22 watts. *Approx. Weight:* 22.55 lbs.

329B-2 APPROACH HORIZONS — 3 in. forward view pitch and roll instrument with glideslope reference and computed steering pointer indications. Glideslope and localizer warning flags indicate radio signal failure.

329B-4 APPROACH HORIZONS — Larger 4 in. forward view pitch and roll instrument with two-color horizon background, internal wedge lighting. Large, red warning flags indicate unreliable steering, gyro, glideslope or localizer signals. Red or white lighting. Pitch indications to 85° above and below the horizon; roll indications cover the complete 360° range of indication.

331A-2 COURSE INDICATORS — Standard 3 in. instrument showing pictorial plan view of the navigation situation. Matte white markings. 5° azimuth markings.

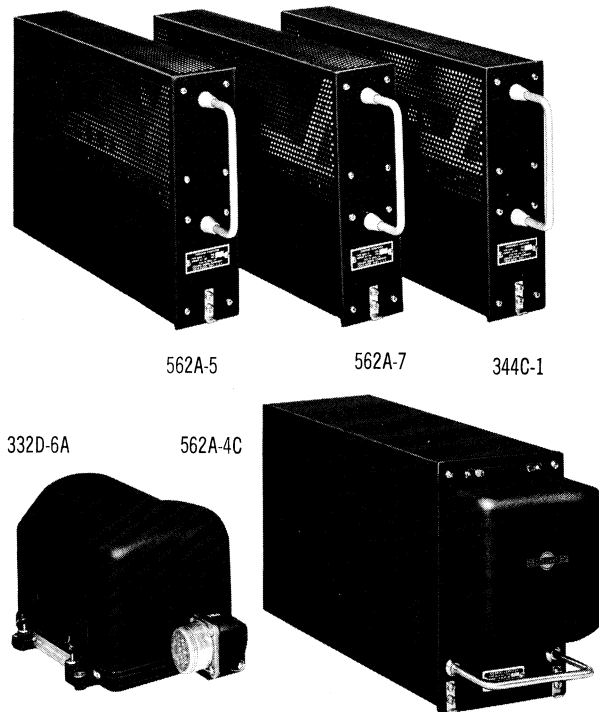
331A-4 COURSE INDICATORS — Larger 4 in. plan view navigation situation instrument. Integral wedge red or white lighting. Warning flag indicates loss of compass signal. All markings are matte white. The 331A-4A includes a glideslope pointer on the left side and glideslope and localizer warning flags. The 331A-3C, a 3" version with integral lighting, is available in a clamp mounted model.

327B-1W GYRO MONITOR — Indicates the operating condition of the vertical gyro. Matte white markings.

562A-5 STEERING COMPUTER — Provides steering information to the steering pointer on the Approach Horizon. Data concerning localizer deviation, heading error and bank angle is used to compute horizontal guidance signal and feed the steering pointer. ¼ ATR short case.

562A-4C STEERING COMPUTER — Provides steering information identical to 562A-5 in a ½ ATR short case.

562A-7 STEERING COMPUTER — Extremely lightweight version providing steering information identical to the 562A-5 plus signal monitoring and excitation of the Vertical Gyro and a self-contained bank erection-cutout circuit which is adequate



for standard flight operation, eliminating the need for the 345A-2 Sensing Unit. Utilized with the FD-107.

344C-1 INSTRUMENT AMPLIFIER — Normally consists of 3 servo amplifiers — one each for the bank, pitch and compass servos — and two flag-alarm circuits controlling warning flags indicating servo channel failure.

345A-2 SENSING UNIT — Consists of a yaw rate gyro which, through relays, interrupts power to the vertical gyro during turns to prevent gyro precession.

332D-6A VERTICAL GYRO — A non-tumbling vertical reference which supplies signals in proportion to the roll and pitch of the aircraft. The bank pickoff is active for ±100°, while the bank freedom is ±360°. Pitch pickoff is active ±52° with a freedom of ±85°.

332D-8 VERTICAL GYRO — Non-tumbling vertical reference providing pitch and bank information to the FD-105. Standard synchro pickoffs are used which permit use with other systems requiring 2 or 3 wire ac. Bank is 360°, pitch freedom ±85°.

	FD-104				FD-105				FD-107						
	Type	Dimensions (inches)			Weight (lbs.)	Type	Dimensions (inches)			Weight (lbs.)	Type	Dimensions (inches)			Weight (lbs.)
		W	H	D			W	H	D			W	H	D	
Approach Horizon	329B-2W	3½	3½	6½	2.3	329B-4A	4	4	6¾	4.2	329B-2	3½	3½	6½	2.3
Course Indicator	331A-2CW	3¼	3¼	9	4.0	331A-4	4	4	6¾	4.6	331A-2CW	3¼	3¼	9	4.0
Gyro Monitor	327B-1W	1¼	1%	2¾	.5	.....	.....	.....	.....	.....	327B-1W	1¼	1½	2¾	.5
Vertical Gyro	332D-6A	5⅞	5⅞	9¾	6.5	332D-8	9½	6¼	5⅞	7.5	332D-6A	5⅞	5⅞	9¾	6.5
Steering Computer	562A-4C	½ ATR Short			15.4	562A-5	¼ ATR Short			8.3	562A-7	¼ ATR Short			8.3
Sensing Unit	345A-2	4½	5½	16%	3.3	345A-2	4½	5½	16%	3.3	.....	.....	.....	.....	.....
Instrument Amplifier	.....	.....	.....	.....	.....	344C-1	¼ ATR Short			7.3	.....	.....	.....	.....	.....
Shockmount	350M-2	½ ATR Short			3.7	390F-5	Dual ¼ ATR Short			2.3	390D-7	¼ ATR Short			1.3

Collins Automatic Pilot Systems, designed for all aircraft from executive twin to jet airliner, precisely control aircraft flight attitude in any mode of operation. Transient-free engagement and smooth "fade-in, fade-out" changes in control functions allow smooth flight characteristics during mode selection. All incorporate modular construction, magnetic amplifiers and transistors — no tubes are used.

As a Flight Director-Automatic Pilot combination, the Collins Integrated Flight Systems provide a continuous and complete attitude and navigational situation monitor.

AP-103 AUTOMATIC PILOT SYSTEM — The newest version of Collins Automatic Pilots, the AP-103 is designed to automatically control all high performance commercial and executive aircraft including airline and executive jets. The AP-103/FD-105 combination provides automatic flight on Doppler track, localizer or VOR beams with crosswind correction; smooth flight across VOR stations; automatic control of altitude, heading, rate of turn and pitch attitude; automatic ILS approach with crosswind correction; manual ILS approaches with flight director steering; air speed compensation; preselected heading; integrated flight instrumentation and flight director services; optional automatic glideslope capture, yaw damping and mach hold. *Approx. Weight:* AP-103/FD-105 — 131.65 lbs. (includes vertical reference).

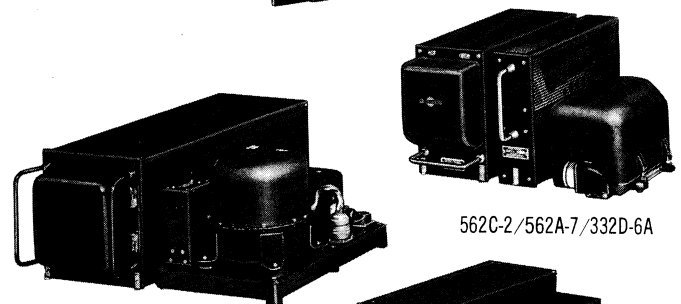
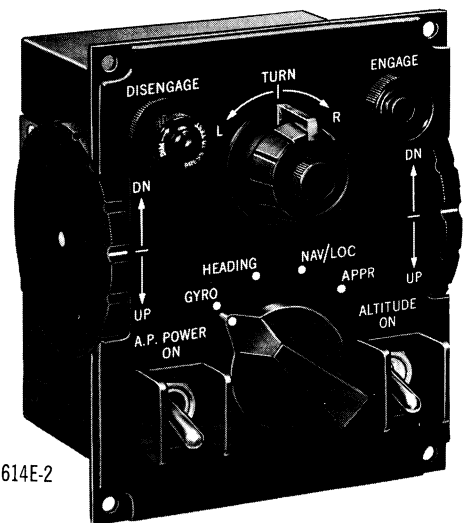
AP-102 AUTOMATIC PILOT SYSTEM — The AP-102 is a lightweight system providing automatic pilot services in the airliner range from four engine reciprocating and turboprop airliners down through executive twin aircraft. Combined with the flight director, the AP-102 flies the aircraft automatically in response to heading signals during cross country and localizer-glideslope signals (including crosswind correction) during approach, in addition to other standard automatic flight control features. System combines with the FD-107. *Approx. Weight:* AP-102/FD-107 — 81 lbs.

AP-101E AUTOMATIC PILOT SYSTEM — The AP-101E provides automatic pilot services in the same range as the AP-102. Operation is similar to the AP-102. The system combines with the FD-104 or FD-105. *Approx. Weight:* AP-101E/FD-104 — 145 lbs. AP-101E/FD-105 — 156 lbs.

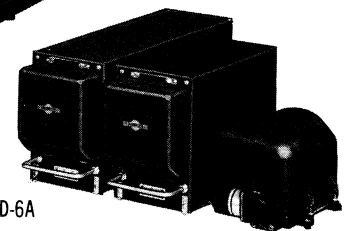
614E-2 FLIGHT CONTROLLER — All control functions including pitch control, four position mode selection, engage and bank control are provided in an edge lighted, pedestal mounted unit.

562A-6 STEERING COMPUTER — The 562A-6 supplies steering information to the Approach Horizon, lateral guidance signals to the 562C-1A, allows transient free guidance over VOR stations and provides automatic crosswind correction in NAV and approach modes. *Shockmount:* 349J-1.

562C-1A, -2 COMPUTER AMPLIFIER — Servo amplification, vertical guidance computation, trim coordination, transducer excitation and relay service are provided by the 562C-1A for the AP-101E System.



562C-3/332D-9



562A-6/562C-1A/332D-6A

The 562C-2 (AP-102) includes servo amplification for all three control axes, main power transformer and isolated voltage supplies. *Shockmounts:* 562C-1A — 349J-1. 562C-2 — 349D-4.

562C-3 COMPUTER AMPLIFIER — Includes above services plus necessary switching and fading functions for the AP-103 System; flight director steering computer circuitry; horizontal guidance to the steering pointer of the 329B-4 Approach Horizon and provisions for optional yaw stabilization. *Shockmount:* 562C-3 — 349D-5.

614E-3 SWITCHING UNIT — Fading, switching and other control circuits are provided for AP-101E, -102. *Shockmount:* 349J-1 or 349P-1.

590A-2 ALTITUDE CONTROLLER — A controller signal is generated by the 590A-2 to level off and maintain flight at a constant pressure altitude.

345A-3, -4 SENSING UNIT — Yaw, roll and pitch rate gyros and a relay box are contained in the 345A-3. The 345A-4 for AP-103 contains two rate gyros sensing pitch and roll.

334C-2 PRIMARY SERVOS — Composed of two parts, a drive unit and a control unit, the Primary Servos position control surfaces when the automatic pilot is in control. Either capstan or lever arm configuration. Two counter rotating hysteresis clutches driven by a continuously rotating dc motor apply power through an adjustable torque limiting clutch to the cap-

	AP-101E/FD-105, FD-104				AP-102/FD-107				AP-103/FD-105						
	Type	Dimensions (inches) W H D			Weight (lbs.)	Type	Dimensions (inches) W H D			Weight (lbs.)	Type	Dimensions (inches) W H D			Weight (lbs.)
Steering Computer	562A-6	½ ATR Short			17.5	562A-7	¼ ATR Short			8.2	562C-3	¾ ATR			49.0
Computer Amplifier	562C-1A	½ ATR			29.0	562C-2	½ ATR Short			21.25					
Pedestal Controller	614E-2	4½	5½	4½	2.75	614E-2	4½	5½	4½	2.75	614E-2	4½	5½	4½	2.75
Switching Unit	614E-3	5¾	3¾	6	3.25	614E-3	5¾	3¾	6	3.25	.....	.....	.....	.....	.....
Altitude Controller	590A-2	5¾	5	6¾	2.25	590A-2	5¾	5	6¾	2.25	590A-2	5¾	5	6¾	2.25
Sensing Unit	345A-3	4½	3	15	7.6	345A-3	4½	3	15	7.6	345A-4	5	5¼	8¾	4.0
Primary Servo (3 required)	334C-2	7	5¾	10¾	(total) 40.5	334C-4	3¾	3¾	6¼	(total) 12.75	334C-3	7½	4¾	8½	(total) 10.0
Servo Mount (3 required)	334B-	Included above			(total) 9.0	351B-4	3¾	3¾	3	(total) 6.75	351B-3	Included above			(total) 30.0
Trim Tab Servo	334D-1	4	4	9½	6.5	334D-1	4	3¾	9½	5.5	344D-2-33	4	3¾	9½	6.5
Trim Indicator	327D-1W	4	2	1¾	0.5	327D-1W	4	2	1¾	0.5	327D-1	4	2	1¾	0.5
Disconnect	121A-1	3½	8½	7¾	1.3	121A-2	17/8	3¼	4¾	0.4	121A-2	17/8	3¼	4¾	0.4
Vertical Reference	332D-8 332D-6A*	9¾	5¾	5¾	6.0	332D-6A	9¾	5¾	5¾	6.5	332D-9	8¾	8	13¾	17.0
Gyro Monitor	327B-1W (not req. with FD-105)	1¼	15/8	2¾	.4	327B-1W	1¼	15/8	2¾	.4	.....	.....	.....	.....	.....
(Optional) Airspeed Compensator	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	590B-1	6¼	4¾	5¼	4.0
Approach Horizon	329B-4 329B-2AW*	4 3½	4 3½	6¾ 6½	4.0 2.3	329B-2AW	3½	3½	6½	2.3	329B-4	4	4	6¾	4.0
Course Indicator	331A-4 331A-2CW*	4 3¼	4 3¼	7¾ 9	4.6 4.0	331A-2CW	3¼	3¼	9	4.0	331A-4	4	4	7¾	4.6
Instrument Amplifier	344C-2 (not req. with FD-104)	¼ ATR Short				.....	.....	.....	.....	.....	344C-1	¼ ATR Short			5.0

*For AP-101E/FD-104 combination

stan. The electrical engage clutch in connection with the disconnect switches and the torque limiting clutch provide a positive safety feature. Three Primary Servos are required.

334C-3, -4 PRIMARY SERVOS — Controlled voltage split-field series dc servomotors actuate the 334C-3 and -4 Primary Servos. 331C-3 output torque is limited by a precision torque limiting clutch located in the gear train ahead of the electrical engage clutch. 331C-4 output is electrically limited.

334D-1 TRIM TAB SERVO — Direct drive servo. Magnetic clutch electrically engaged.

334D-2-33 TRIM TAB SERVO — Direct drive servo. Additional clutch provides override without disconnect.

121A-1 MECHANICAL DISCONNECT — Independent manual disengagement and an emergency device for disconnecting AP-101 trim tab and primary servos.

121A-2 EMERGENCY DISCONNECT — Positive knife switch interlocked with the electrical engage circuitry of the AP-102, -103 primary servos.

332D-6A VERTICAL GYRO — 332D-6A provides the prime vertical reference for AP-101E, -102 operation. Bank signals

are available between ±100° with bank freedom of 360° and pitch signals between ±52° with freedom of pitch between ±85°. Automatically caged when turned off.

332D-9 VERTICAL REFERENCE — This self-contained central data source supplies basic attitude information to the AP-103 and attitude instruments. Additional outputs for radar and other equipment. A warning signal capable of operating a warning flag, light or relay, a yaw rate gyro, power and isolation circuitry is included. Gyro has 360° freedom of roll and ±82° pitch range.

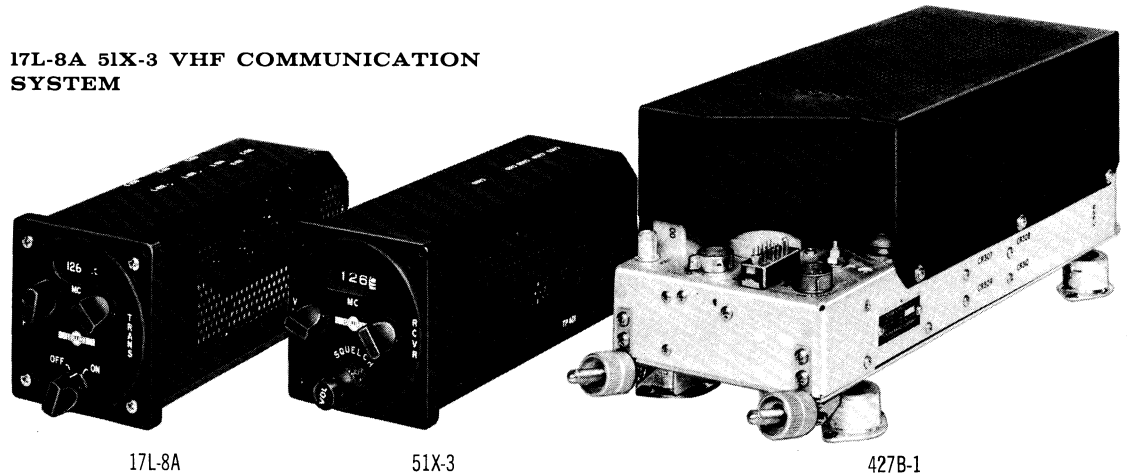
327B-1W GYRO MONITOR — Safe application of power to gyro motor rotor and torque erection motors is indicated.

327D-1W TRIM INDICATOR — Trim indication is provided in all three axes.

590B-1 AIRSPEED COMPENSATOR — (Optional) Performs parameter scheduling when gains must be varied as a function of airspeed.

IFS COMPONENTS — Components common to the Flight Directors and Automatic Pilots are described on the preceding pages. Chart above indicates required equipment.

17L-8A 51X-3 VHF COMMUNICATION SYSTEM



17L-7/51X-2 VHF COMMUNICATION SYSTEM—Maintaining the “Airline Standard of Quality” of their predecessors, the 17L-7 and 51X-2 combine extended frequency coverage and reliability with reduced size and weight. In addition to wide use by the military, international, domestic and local service airlines, the system is popular for business aircraft fleets. Both designed for ARINC cooling. *System Weight Including 390E-2 Dual Shockmount: 27 lbs.*

17L-8A/51X-3 VHF COMMUNICATION SYSTEM—A light-weight airborne communication system for private and executive aircraft. Built to airline standards, the panel mounted receiver and transmitter are less than 9” long and incorporate digital tuning, crystal control and low power requirements. The system weighs 10.75 lbs., including power supply, and will mount in any single engine or heavier aircraft without weight penalty. No additional shockmounting required.

17L-4, -6/51R-3 VHF COMMUNICATION SYSTEM—Long in use by airlines and military aircraft throughout the world. *System Weight: Approx. 65 lbs. Shockmount: 350F-3.*

17L-7 VHF COMMUNICATION TRANSMITTER—The 17L-7 provides 680 crystal-controlled channels with 50 kc spacing between 118.0 and 151.95 mc. Only six tubes and five transistors are utilized, with four additional transistors in the dc power supply. Remote control frequency selection permits operation in SCS, DCS or DCD. Power output is 25 watts. DC or ac power supplies integral. Operates without pressurization to 30,000 feet. *Shockmount: 349H-3.*

51X-2 VHF COMMUNICATION/NAVIGATION RECEIVER—The 51X-2 provides reception on 880 crystal-controlled channels between 108.0 and 151.95 with 50 kc spacing. This includes all VHF communication, VOR and localizer frequencies. With the VOR/LOC instrumentation unit, complete navigation

reception is provided. DC or ac power supplies are integral. Features are modularized construction, extended frequency coverage, reduced size and weight, increased reliability and transistorized dc power supply. *Shockmount: 349H-4.*

17L-8A VHF COMMUNICATION TRANSMITTER—The 17L-8A is a crystal-controlled 90 channel transmitter with frequency coverage from 118.0 to 126.9 mc in 100 kc increments. Power output is 3 watts. It is primarily intended to provide, along with the 51X-3, increased communication potential for twin and single engine ‘light’ aircraft. It is constructed in a standard 3” instrument case to be mounted on the instrument panel of any aircraft. The 17L-8A may be used with either 13.5 or 27.5 v systems. The 17L-8 is a 27.5 v model.

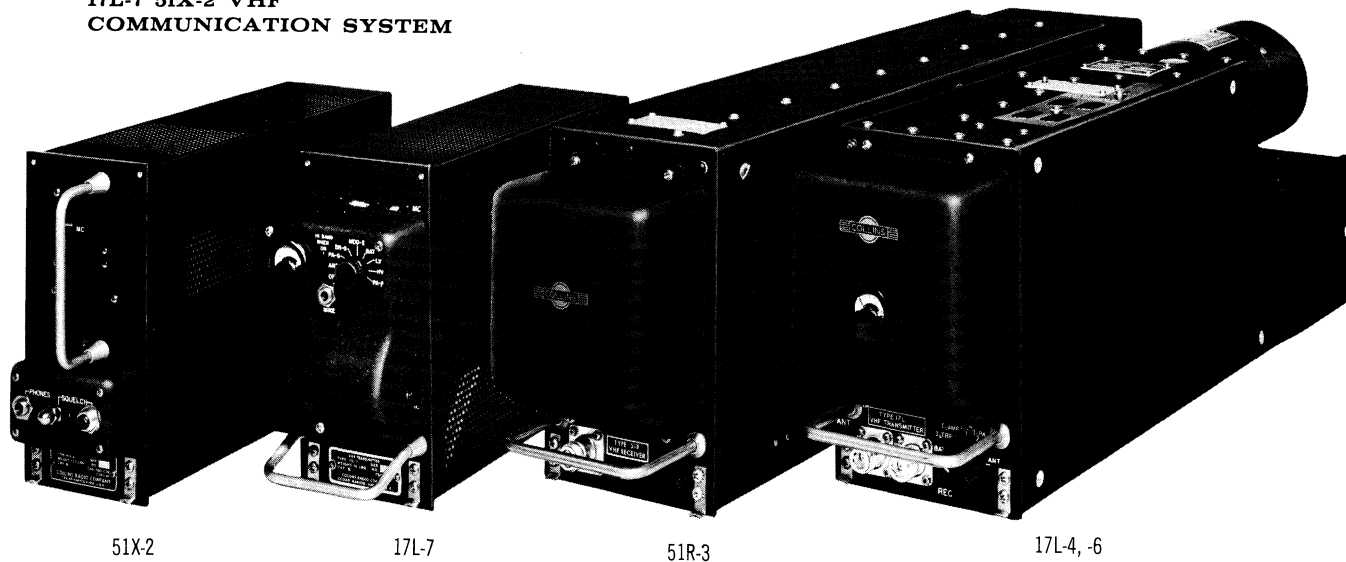
51X-3 VHF COMMUNICATION/NAVIGATION RECEIVER—Built in the same type case as the 17L-8A, the 51X-3 provides 190 crystal-controlled channels between 108.0 and 126.9 with 100 kc spacing. Combined with the 344A-1, it provides complete navigation and communication service. Combines with the 344D-1 Omni Converter to provide localizer or omni course deviation and ambiguity indication in a completely panel mounted system. Mounts on any aircraft panel.

427B-1, -2 POWER SUPPLY—Provides transistorized power supply and modulator, IF strip and audio amplifier for the 51X-3/17L-8A combination. 427B-1 is for 27.5 v systems, 427B-2 for 13.5 v. 427A-1 Power Supply—Modulator/Power Supply for 17L-8A alone, 27.5 v dc only.

17L-4, -6 VHF COMMUNICATION TRANSMITTER—25 watts transmitter output with 360 crystal-controlled channels spaced 50 kc between 118.0 and 135.95 mc. The 17L-6 is identical to the 17L-4 with the addition of an audio clipper which reduces overmodulation and distortion. *Shockmount: 350E-3C.*

17L-4,-6 51R-3 VHF
COMMUNICATION SYSTEM

17L-7 51X-2 VHF
COMMUNICATION SYSTEM



51R-3 VHF COMMUNICATION/NAVIGATION RECEIVER

— A 280 channel crystal-controlled receiver with 100 kc spacing between 108.0 and 135.9 mc. Receives all VOR/LOC and communication frequencies and with the accessory frame and accessories provides full instrumentation facilities. *Shockmount:* 350E-3A. External power supply required.

351A-1 ACCESSORY FRAME — Provides mounting surfaces for 51R-3 accessories — two 337A Omni-Bearing Indicators, three 333B Servo Amplifiers and two 416N-1, N-5 or N-6 Power Supplies. This arrangement complements two 51R-3 Receivers. *Shockmount:* 350E-3A.

333B-1, -3 SERVO AMPLIFIER — Required to drive each Radio Magnetic Indicator card from a gyro-stabilized compass. The 333B-1 is for mounting on the 351A-1 Accessory Frame; the 333B-3 includes a base for separate mounting.

416Z-1 POWER SUPPLY — For the 17L-4, -6, a transformer-

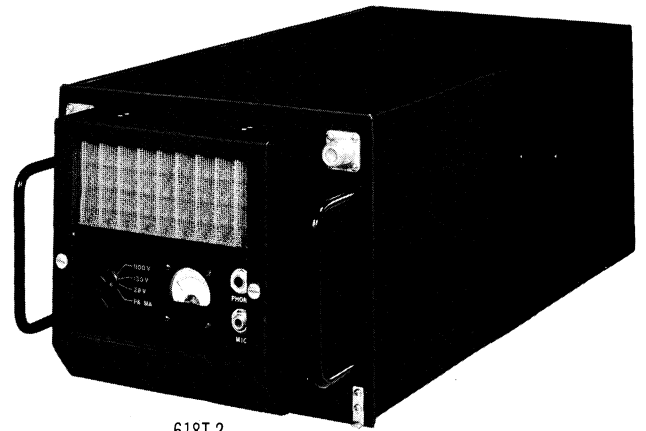
rectifier type for use where both 27.5 v dc and 115 v, 300-1,000 cps sources are available. Replaces dynamotor normally supplied with 17L-4, -6. Especially needed where dc main supply is limited.

416N-1 POWER SUPPLY — For the 51R-3, a conventional dynamotor supply for 27.5 v dc. Plugs into 351A-1 Accessory Frame or separate mounting base.

416N-5 POWER SUPPLY — For the 51R-3, a conventional ac supply for use with 115 v, 300-1,000 cps source. Plugs into 351A-1 or separate mounting base.

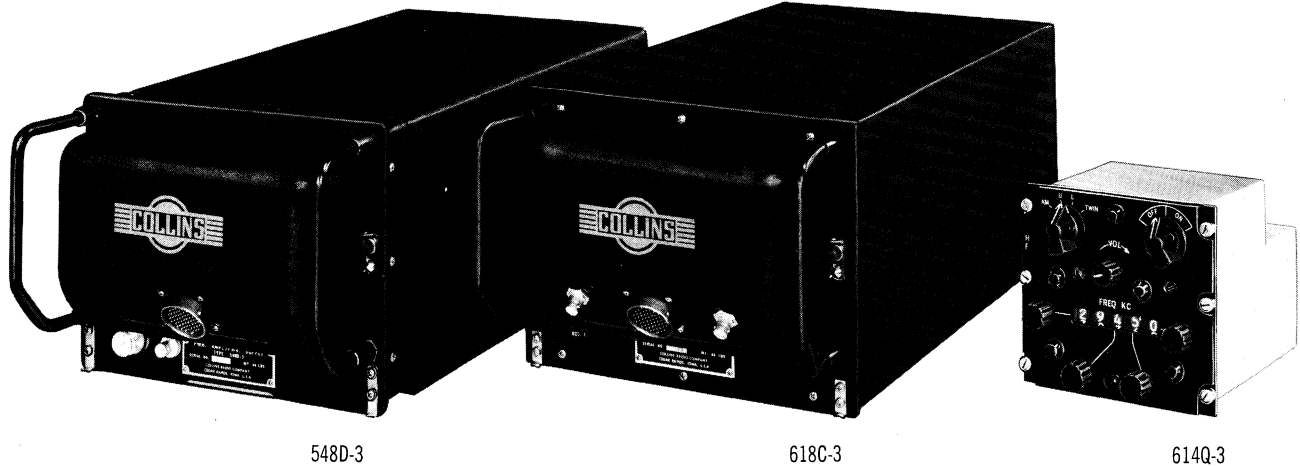
416N-6 POWER SUPPLY — For the 51R-3, a new transistorized supply for 27.5 v dc. Reduces weight of present 51R-3 installations and requires less maintenance. B+ voltage is supplied from 26.5 v dc by a transistorized oscillator-rectifier circuit. Interchanges with the 416N-1 with no wiring changes.

	Type	Dimensions (Inches)			Channels	Weight (lbs.)	System Combination		Dimensions (Inches)			Channels	Weight (lbs.)	System Combination	
		W	H	D					W	H	D				
Transmitter	17L-4, -6	½ ATR long			360	29.0	51R-3	Power Supply	427B-1, -2	5½ 5½ 14	.....	6.5	17L-8A and 51X-3		
Transmitter	17L-7	¾ ATR short			680	14.0	51X-2								
Transmitter	17L-8	3	3	8½	90	2.25	51X-3	Accessory Frame	351A-1	½ ATR		.....	7.3	51R-3	
Transmitter	17L-8A	3	3	8½	90	2.25	51X-3	Servo Amplifier	333B-1, -3	6¼	5½	7½	.....	2 or 2.4	351A-1
Receiver (Comm/Nav)	51R-3	½ ATR long			280	29.5	17L-4, -6	DC Power Supply	416Z-1	.....			.....	6.6	17L-4, -6
Receiver	51X-2	¾ ATR short			880	10.5	17L-7	AC Power Supply	416N-5	.....			.....	8.2	51R-3
Receiver	51X-3	3	3	8½	190	2.75	17L-8, -8A	DC Power Supply	416N-6	.....			.....	4.8	51R-3



618T-2

18Z-3,-4 ONE KW SYSTEM



548D-3

618C-3

614Q-3

High frequency single sideband communication systems relieve spectrum congestion while greatly improving the quality of high frequency communication. Output power in AM is divided between the carrier and two sidebands while SSB radiated energy is concentrated in one sideband resulting in a four to one power advantage for a given output rating. SSB is essentially immune to selective fading. Collins Mechanical Filters eliminate the unwanted sideband and suppress the carrier. RF negative feedback techniques provide power amplification linearity to avoid distortion products. Frequency mixing schemes result in a comparatively simple transmitter-receiver combination with a low spurious product. Automatic servo tuning insures precision in tuning, simplifies operation and facilitates multichannel design.

18Z-3, -4 1 KW SYSTEM — Fully automatic, 28,000 channel SSB airborne communication is provided in the 2 to 30 mc range in consecutive 1 kc steps by the 18Z. Power output is 1 kw PEP. The system includes a 618C-3 Receiver-Exciter unit, a 548D-3 or -4 Power Amplifier and one or more 614Q-3 Remote Control units.

The 18Z-3 is the unpressurized version and it employs an auxiliary fan for cooling; the 18Z-4 uses a pressurized power amplifier unit, with an air-to-air heat exchanger requiring external cooling air.

The equipment is extremely simple to operate, with the desired frequency set directly on a counter-type dial. Any of four

operational modes may be selected: upper sideband, lower sideband; twin sideband (both sidebands, suppressed carrier), and AM (upper sideband with reinserted carrier).

Either "Voice operate" or push-to-talk actuation of the transmitter may be used. A stabilized master oscillator is referenced to a compact frequency standard with stability of better than one part in 10^6 per month. The 1 kw power amplifier provides excellent linear operation as a result of optimum operating levels and use of RF feedback.

Several accessory antenna couplers and tuners are available in both pressurized and unpressurized versions.

Impedances: Receiver RF input and transmitter RF output — 52 ohms. Receiver audio output and transmitter audio input — 150 ohms. *Primary Power:* 115 v (line-to-neutral), 3 phase, 380-420 cps, 1200 watts (SSB transmit).

614Q-3 REMOTE CONTROL — Frequency selection for the 18Z is accomplished by four manual setting knobs on the front panel. These knobs control selection of megacycle, tenths of megacycle, tens of kilocycle, and units of kilocycle. Frequency selection automatically initiates operation of a servo bridge follow-up system to tune the radio. Other front panel controls on the back lighted panel are: Upper, Lower, AM or Twin Sideband mode selection, a Sensitivity Control and an ON-OFF switch. Several control boxes may be used in one system.

180R-6 ANTENNA COUPLER — In conjunction with the 309A-2, automatically loads and tunes fixed wire antennas.

Cooling air is supplied by an internal blower. The 180R-6 contains antenna loading and phasing elements and driving motors for resonating the antenna and matching the impedance of a wire antenna to the 52 ohm output impedance of the power amplifier. The automatically-tuned impedance matching network will operate over the full 2 to 30 mc range.

Also included are tuning and loading elements, a portion of the switching circuits, servo motors, antenna transfer relay and lightning arrestor assembly. Operates without pressurization to 20,000 feet. Pressurized version available.

309A-2 ANTENNA COUPLER CONTROL — Includes relay and switching control to assist the 180R-6 in loading and tuning a fixed wire antenna. The 309A-2 can provide multicouplers for coupling the antenna to either an auxiliary HF receiver or an auxiliary Loran receiver. Operates without pressurization to 75,000 feet.

AT-101/AT-102 ANTENNA TUNERS — Automatically couples Collins airborne HF communication equipment with tail cap antennas. AT-101 is for single transmitter-receiver; AT-101A will accommodate one auxiliary receiver. AT-102 is for dual installations and one or two auxiliary receivers. AT-101/AT-102 include pressurized the 452A-1 Lightning Arrestor and Relay Assembly and one or two 180R-4 Couplers plus one or two 309A-1 Coupler Accessory Units.

618T-2, -3 400 WATT TRANSCEIVER — The 618T provides HF SSB communication on 28,000 channels with 1 kc spacing in the 2 to 30 mc range with 400 watts PEP. Compatible AM transmission is available with 100 watts carrier. The

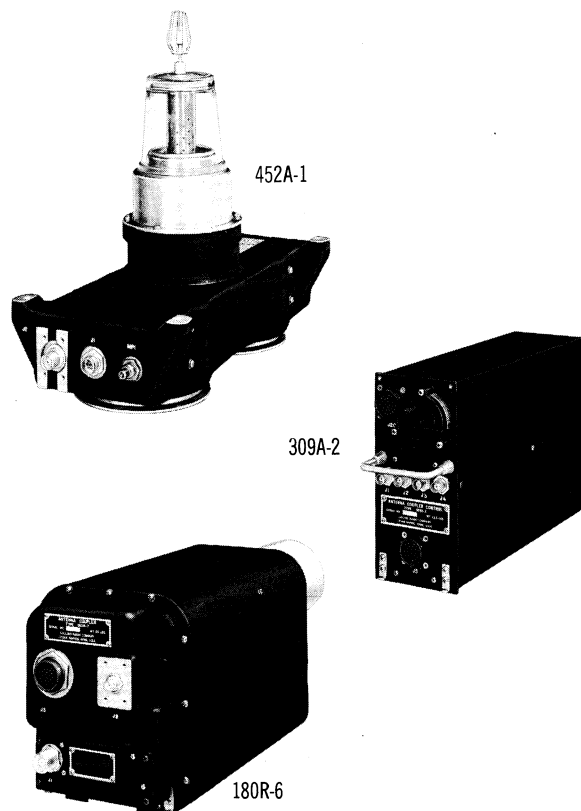
618T-2 contains an internal 115 v, 3 phase, 400 cps power supply. The 618T-3 has a self-contained dc power supply.

Frequency stability is one part per million plus 2.5 cps error per month. Two tubes in parallel provide the 400 watts PEP. The injection sources of the 618T are phase locked to an internal frequency standard to provide excellent stability. Frequency control is accomplished with a stabilized master oscillator and stabilized crystal oscillators.

Remotely controlled Autopositioners® provide for frequency selection in the transceiver. Power amplifier and antenna matching circuits are automatically tuned. A blower on the front panel distributes filtered cool air to the main chassis. The 49T-3 Retrofit Adapter used with 350S Shockmount facilitates installation of the 618T in an airframe cabled for a 618S HF System.

No. of Tubes: 14. No. of Transistors: 62. Transmitting RF Output Impedance: 52 ohms. Transmitter Distortion: Less than 5%. Receiver Sensitivity: 3 uv max. for 6 db signal-plus-noise-to-noise ratio with standard test signal modulated 30% at 1,000 cps or for 10 db signal-plus-noise-to-noise ratio on SSB. Selectivity: AM—5.5 kc, 6 db down; 14 kc, 60 db down; SSB—2.85 kc, 6 db down; 6 kc, 60 db down. Audio Output: Power—500 mw into 300 ohm load. Distortion—less than 10%. Response—±3 db, 300 to 3,500 cps.

714E-1 REMOTE CONTROL UNIT — Contains all controls necessary for frequency selection of any one of the 28,000 channels of the 618T. Provides direct readout of frequency and for selection of lower sideband, upper sideband or AM operation. The 714E-1 Remote Control may be mounted in the flight station. The unit is back lighted.



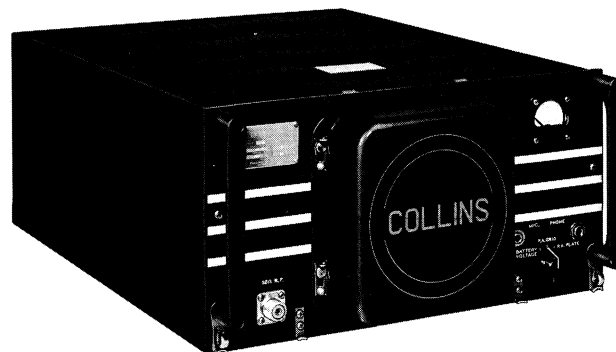
	Type	Dimensions (inches)			Weight (lbs.)	System	Shock-mounts
		W	D	H			
Receiver Exciter	618C-3	1	ATR		59.5	18Z-3, -4	349E-3
Power Amplifier (non-pressurized)	548D-3	1	ATR		53.0	18Z-3	349F-4
Power Amplifier (pressurized)	548D-4	1	ATR		72.0	18Z-4	349F-5
Control	614Q-3	5¼	7½	5¼	4.6	18Z-3, -4	Console
Antenna Coupler	180R-6	7	25½	9½	24.6	18Z-3, -4	349G-3
Coupler Accessory	309A-1	¾	ATR Short		12.5	18Z-3, -4	349N-1
Coupler Control	309A-2	¾	ATR Short		15.0	18Z-3, -4	349N-1
Lightning Arrestor — Relay Assembly With Antenna Tuner	452A-1 & 180R-4	7½	16½	25¼	24.0	18Z-3, -4	.....
Lightning Arrestor — Relay Assembly With Antenna Tuners	452A-1 & 180R-4	7½	16½	25¼	37.0	18Z-3, -4	.....
Transceiver	618T-2, -3	1	ATR		47.0	618T-2	350S-3
Control	714E-1	5¼	5½	2½	1.5	618T-2	Console

618S-1, -4 HF TRANSCEIVERS — With up to 144 crystal-controlled channels in the 2 to 25 mc range, the 618S-1 provides 100 watt voice or CW output for long range HF communication. The 618S-1 employs modular construction, Mechanical Filters and automatic tuning. The 618S-4 includes a module which has squelch and Selcal output circuitry. Requires 28 amps at 27.5 v dc and 180 watts at 115 v ac, 400 cps. Remote tuning through the use of Autopositioner and servo control. Full operation to 50,000 feet. *Frequency Stability:* 0.007%. *Channeling Time:* 8 sec. max. excluding tuning unit. *Spurious Radiation:* 45 db below desired frequency, second harmonic 35 db below desired frequency. *Sensitivity:* 5 uv max. for 6 db signal-plus-noise-to-noise ratio with 30% modulated signal. *Selectivity:* 5.5 kc min. 6 db down, 14 kc max. 60 db down.



618S-1

18S-4A HF TRANSMITTER-RECEIVER — A self-contained transmitter, receiver and power supply, the 18S-4A provides up to 20 crystal-controlled channels in the 2 to 18.5 mc range with 100 watt output on voice or CW. The receiver uses a Mechanical Filter in the IF stage for sharp selectivity.



18S-4A

Ten channels are normally provided, but 20 channels may be made available by using two crystals in each channel with no more than 1% spacing. Channels are selected in the transmitter-receiver by a Collins Autopositioner.

Automatic tuning is provided with 180L-2. Transmitter uses three tubes. The receiver section has ten tubes and includes an automatic noise limiter, delayed AVC and BFO. *Power Requirement:* 38 amps, 27.5 v dc.

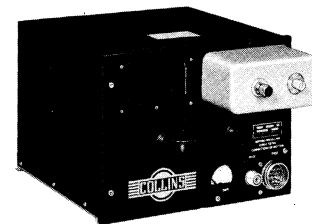
180L-3 AUTOMATIC TUNING UNIT — For the 618S, requires no manual adjustment for initial installation, change in frequency or antenna. Contains antenna transfer relay for use when separate receiving facilities are desired with a common antenna. An SWR indicator is included on the front panel. Tunes long wire antennas 40 to 100 ft. long to appear as 52 ohms resistive. Two discriminators feeding servo systems automatically phase and load the antenna after a signal is received from the transmitter. The 180L-3A contains an internal relay for grounding an adjacent antenna.

	Type	Dimensions (inches) W H D	Wt. (lbs.)	System Combination	Shock-mount
Transceiver	618S-1, -4	1½ ATR long	51	.....	350S-3
Transmitter-Receiver	18S-4A	1½ ATR long	53	.....	350C-5
Automatic Tuner	180L-3	10¾ 7¾ 13¾	20	618S	350D-3
Automatic Tuner	180L-2	10¾ 7¾ 11¾	19	618S/18S-4A	350D-3
Antenna Tuner	180K-3	10¾ 7¾ 10¾	12	18S-4A	350D-3
Power Supply	416W-1, -3	4¾ 6¾ 18¾	22	618S	350T-1

416W-1 POWER SUPPLY — A dynamotor and ac power supply for the 618S. Requires 27.5 v dc at 30 amps on transmit, 6 amps standby; 30 watts, 115 v, 380-420 cps; 150 watts, 115 v, 300-1000 cps.



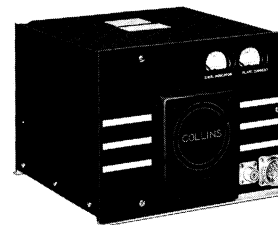
180L-2



180L-3

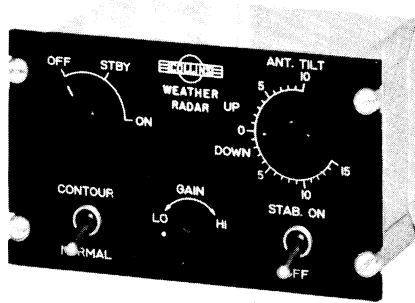
416W-3 POWER SUPPLY — Provides same voltages as 416W-1 from 3 phase, 115 v, 400 cps source.

180L-2 AUTOMATIC TUNING UNIT — For the 618S and 18S-4A. Provides the same functions as the 180L-3 without the antenna changeover feature. Phasing and loading is automatically accomplished.

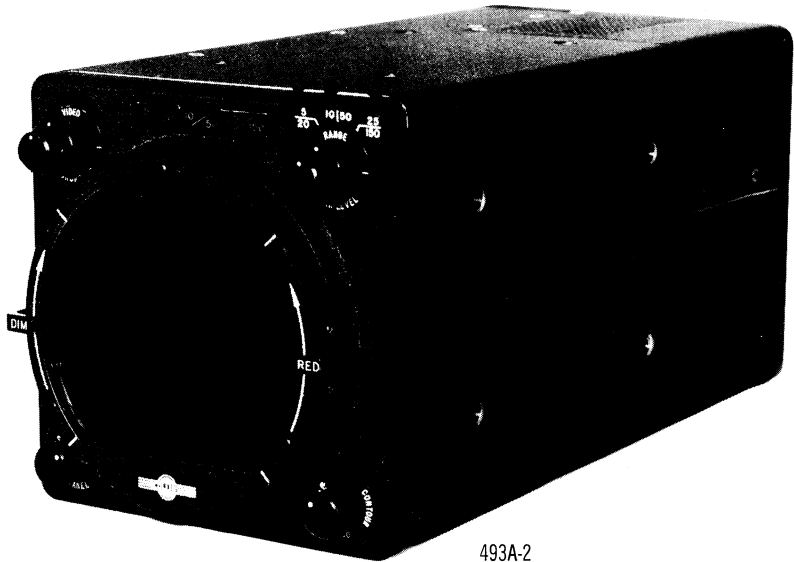


180K-3

180K-3 ANTENNA TUNING UNIT — Matches the output of the 18S-4A to standard aircraft long wire antennas. Uses 10 preset channels which are selected as the 18S-4A channels. The Collins Autotune® system is used to position the tuning elements. The 18S-4A provides all power for the 180K-3.



561G-1



493A-2

The WP-101 Airborne Weather Radar System provides the pilot with a continuous map of precipitation conditions in the sky area within a radius of 150 miles and approximately 240° around the nose of the aircraft. Ranges are 20, 50 and 150 miles. An optional bright tube indicator enables viewing in direct sunlight. Ground mapping, a secondary function, shows the location of cities, lakes, rivers, mountains and shorelines, and it also allows identification of dangerous terrain obstacles. The presentation of weather conditions in terms of range and azimuth relative to aircraft heading enables the pilot to avoid storms or turbulent areas by detours of five miles or less.

Short, high power pulses of RF energy in the C-band 5400 mc range are generated in the transmitter and radiated from the antenna. Between these transmitter pulses, reflections from objects within system range are received and translated by the receiver into video responses appearing as bright spots or lighted areas on the cathode ray indicator tube. Storm areas return echoes according to their precipitation density.

776C-1, -2 SYNCHRONIZER—Contains power supplies, servo amplifiers and basic timing circuitry. Blower cooled. 776C-2 supplies signals for a two-indicator system.

374A-1 RECEIVER/TRANSMITTER — Contains all RF and IF circuitry. Blower cooled. Operates on 5400 mc ±40 mc.

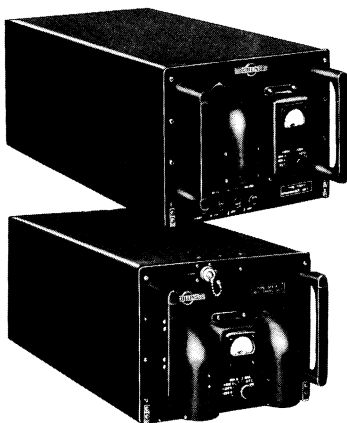
561G-1, -2 COCKPIT CONTROL — Provides control of radar. Presentation and range control is on indicator.

493A-1 INDICATOR — Provides target range and azimuth on conventional yellow face cathode ray tube. Brightness and range controls on indicator. Centered or offset sweeps are available. Straight or offset hoods for daytime use.

493A-2 INDICATOR — Provides offset range and azimuth of targets on a bright storage cathode ray tube with sufficient brightness for use in direct sunlight without hood. Images are stored for almost the duration of one revolution of antenna. Variable color filter adjusts display from green through near white to deep red.

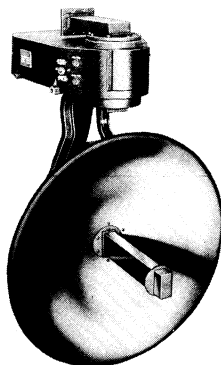
537F-1 ANTENNA — 21" parabolic dish with 7½° beam-width. Rotates continuously through 360° at 15 rpm. Stabilized horizon ±35°.

537F-3 ANTENNA — 30" antenna with approx. 5½° beam-width. Stabilized 30° up and 35° down. Operation identical to 537F-1.



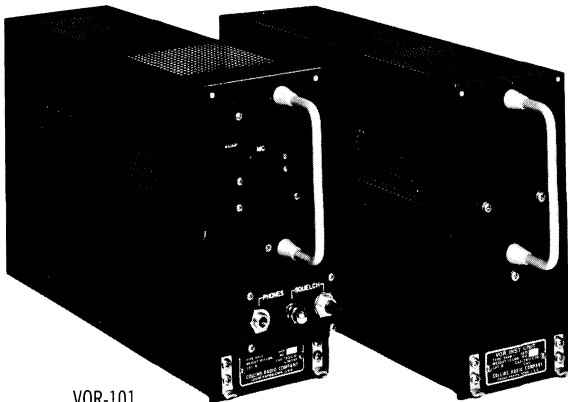
776C-1

374A-1

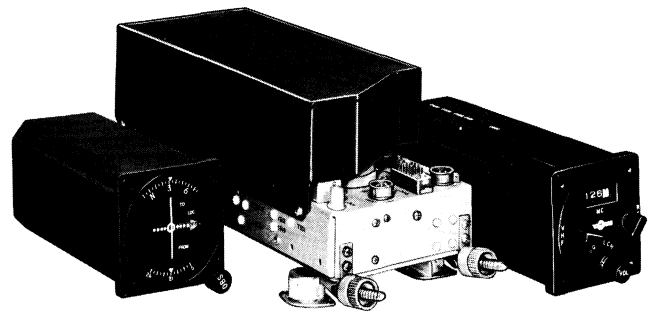


537F-1

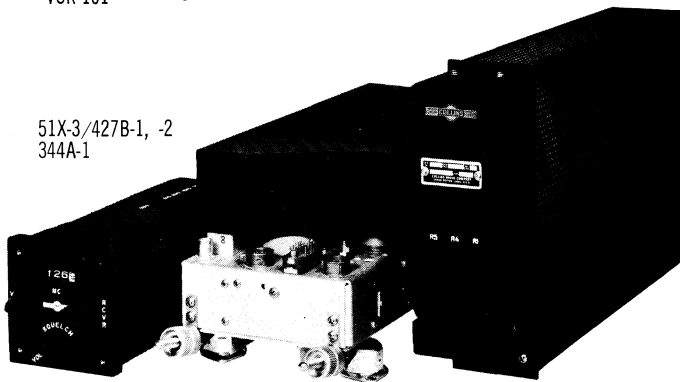
	Type	Dimensions (inches) W H D	Weight (lbs.)	Shockmount
R-T Unit	374A-1	1 ATR	54.0	349A-4
Indicator	493A-1	5" scope	11.0	Panel mount
	493A-2	5" scope	17.3	Panel mount
Antenna	537F-1	20" dish	25.7	.....
	537F-3	30" dish	30.7	.....
Control	561G-1,-2	5¾ 3¾ 3	1.4	.....
Synchronizer	776C-1	1 ATR	34.5	349B-2
	776C-2	1 ATR	38.0	349B-2



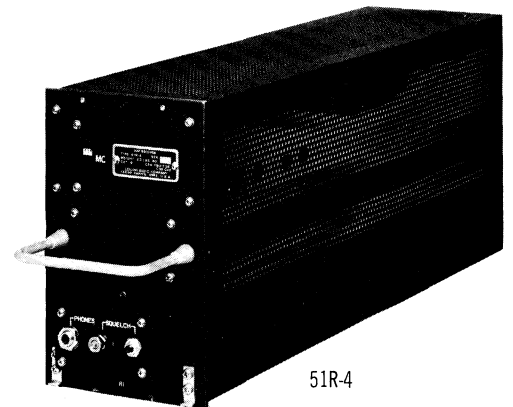
VOR-101



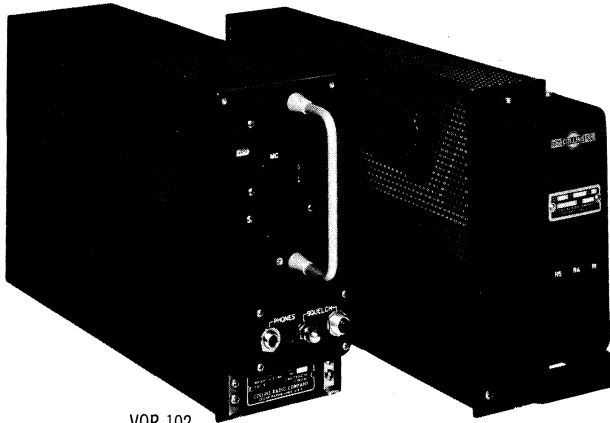
344D-1/427B-1, -2/51X-3



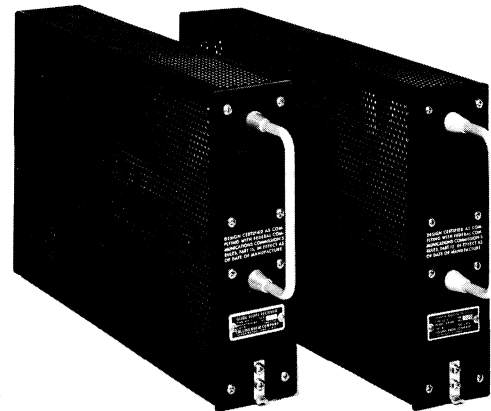
51X-3/427B-1, -2
344A-1



51R-4



VOR-102



51V-3

51Z-2

Collins Navigation Systems provide optional variation in case size, weight and degree of instrumentation. Reliability, accuracy, ease of maintenance and modular construction characterize these five system combinations designed to fit any VHF navigation need from airliner down through single engine aircraft. Units record azimuth runout error of less than ± 0.5 when tested with a precision track selector.

51R-4 NAVIGATION RECEIVER — Complete navigation receiver service in a $\frac{1}{2}$ ATR case. 880 channels with 50 kc spacing between 108.0 and 151.95 mc are provided. OBI and the necessary servo amplifier for RMI instrumentation are included internally. Utilizing the identical modules included in the VOR-101, the 51R-4 takes less frontal space in a radio

rack and utilizes a single power supply. The 51R-4, VOR-101 and VOR-102 provide visual localizer course presentation and simultaneous voice reception from 108.10 through 111.90 mc; visual omnibeam presentation and simultaneous voice reception from 108.00 through 117.95 mc; and VHF reception for voice communication from 118.00 through 151.95 mc. *51R-4 Weight: 23 lbs.*

VOR-101 NAVIGATION SYSTEM — The 51X-2 VHF Receiver is combined with the 344B-1 VOR/LOC Instrumentation Unit to provide the same services as the 51R-4. Consists of two short $\frac{3}{8}$ ATR cases. Utilizing the modules included in the 51R-4, this combination has the advantage of individual replacement, shorter depth in the rack. Units may be

mounted in different locations or in a single dual shockmount. *System Weight:* 24.5 lbs.

VOR-102 NAVIGATION SYSTEM—The 51X-2 VHF Receiver is combined with the 344A-1 VOR/LOC Instrumentation Unit for course selection, cross pointer and flag services for instruments such as the ID-48 and 336A-2, -3 or 331H-1. Utilized where RMI service is not desired. Other functions are identical to 51R-4. *System Weight:* 19.5 lbs.

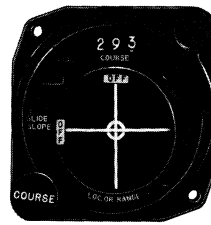
LIGHTWEIGHT DELUXE NAVIGATION SYSTEM—The 51X-3 panel mounted VHF Receiver is combined with the 344A-1 VOR/LOC Instrumentation Unit for same services as the VOR-102. 51X-3 provides 190 crystal-controlled channels with 100 kc spacing between 108.0 and 126.9 mc. Contains necessary switching for simultaneous glideslope and localizer tuning. Front panel channel selection, audio and squelch controls. 427B-1, -2 Power Supply containing audio amplifier and power supply is required. *System Weight:* 18.75 lbs.

LIGHTWEIGHT STANDARD NAVIGATION SYSTEM—344D-1 Omni Converter Indicator is combined with the 51X-3 VHF Receiver for left-right VOR and LOC indication, reciprocal bearing, to-from information and VOR course selection. 427B-1, -2 Power Supply is required to complete system for single engine aircraft. *System Weight:* 13.90 lbs.

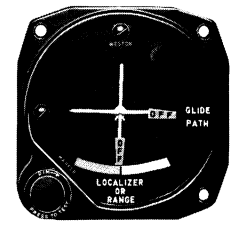
51Z-2 MARKER BEACON RECEIVER—Provides pilot with sharp visual and aural indications of passage over a 75 mc marker beacon. Transistor switches driven from filter outputs turn on lamps. Both one and three lamp versions available. Remotely controlled HI-LO preset sensitivity for more positive indications during instrument approach. Twilight and "no station" hiss are eliminated by a SQUELCH circuit. AC or dc power supplies integral. Three-light version weighs 4.9 lbs., one-light, 3.8 lbs.

51V-3 GLIDESLOPE RECEIVER—Motor driven crystal switch for frequency selection of 20 channels between 329.3 and 335.0 mc. A 10 channel version is available. Flag alarm circuit included. Low power requirements, modular construction for simplified maintenance, ARINC cooling design, advanced component application and integral ac or dc power supplies are incorporated in a ¼ ATR short case weighing only 6.3 lbs.

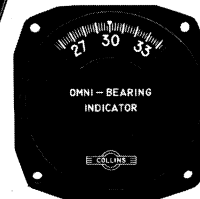
	System	Control	Size W H D	Wt. (lbs.)	Shock- mount	
Receiver	51X-2	VOR-101 or VOR-102	314U-8, -10 614U-3, -7	¾ ATR short	10.0	349H-4 390E-1
Instrumentation Unit	344B-1	VOR-101	.....	¾ ATR short	13.0	349H-5 390E-1
Instrumentation Unit	344A-1	51X-3 or VOR-102	.....	¼ ATR short	9.0	390D-8
Receiver	51X-3	344A-1 and 427B-1, -2	Direct	3" 3" 8½"	2.75	Panel mount
Receiver Instrumentation Unit	51R-4	.....	314U-8, -10 614U-3, -7	½ ATR	23.0	349D-3A
Marker Receiver	51Z-2	.....	Fixed Tuned	¼ ATR short	4.9	390D-2 390F-2
Glideslope Receiver	51V-3	.....	314U-8, -10 614U-3, -7	¼ ATR short	6.4	390D-3 390F-2
Omni Converter	344D-1	51X-3 427B-1, -2	51X-3	3" 3" 8½"	2.4	Panel mount
Power Supply	427B-1, -2	.....	.....	5½" 5½" 14"	6.5	Mount included



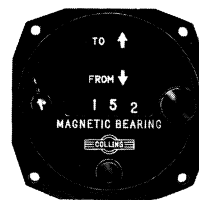
331H-1



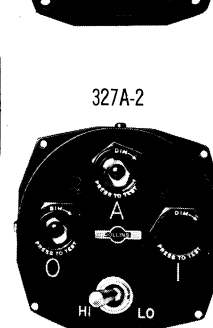
ID-48



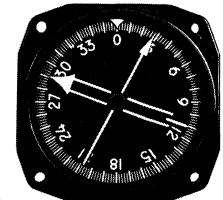
337A-2



336A-2



327A-2



332C-1

331H-1 COURSE SELECTOR INDICATOR—Provides VOR and ILS cross-pointer service, to-from, flag and digital course selector indication. Standard 3" case. *Weight:* 4.0 lbs.

ID-48 DEVIATION INDICATOR—Provides VOR and ILS displacement data. Flag service. Standard 3" case. *Weight:* 1.9 lbs.

337A-2 OMNI-BEARING INDICATOR—Presents true bearing to VOR station and drives RMI pointers. Panel mounted or mounts in 51R-3 accessory frame. Standard 3" case. *Weight:* 2.5 lbs.

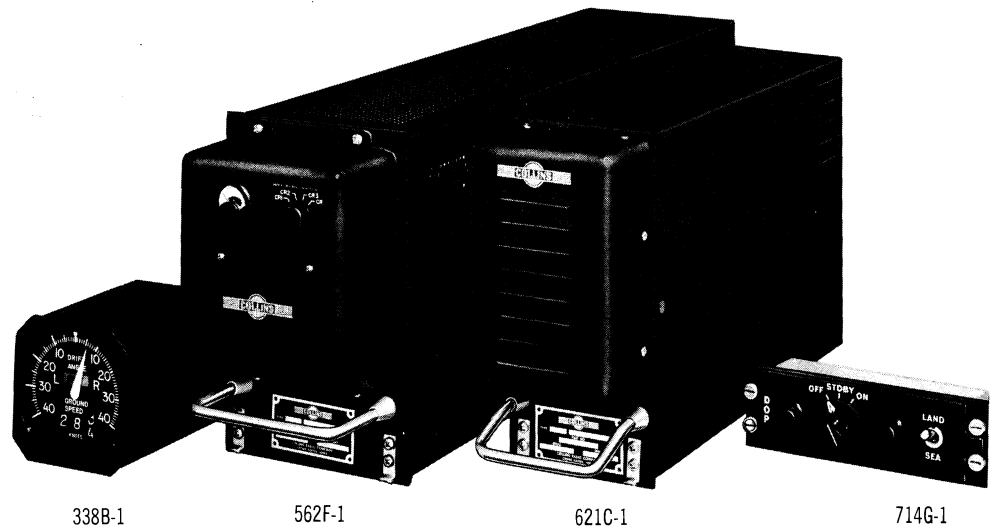
336A-2 OMNI-BEARING SELECTOR—Enables selection of desired track and provides to-from information. Operates with any unit requiring single 30 cps rotor resolver. Matte white or orange markings. Standard 3" case. *Weight:* 2 lbs.

336A-3 OMNI-BEARING SELECTOR—Performs same function as 336A-2 and is for use with either new or old VOR instrumentation units such as 51R-3, 51R-4, 344B-1 and 344A-1. Standard 3" case. Matte white or orange markings. *Weight:* 2 lbs.

332C-1 RADIO MAGNETIC INDICATOR—Provides heading, omni and ADF bearing. Inputs for VOR and ADF. Standard 3" case. Matte white or orange markings. *Weight:* 2 lbs.

331E-2 ADF INDICATOR—Presents VOR and ADF bearing. Variation set knob sets card. *Weight:* 1.5 lbs.

327A-2 MARKER LIGHT INDICATOR—Contains three press-to-test lights and Hi-Low sensitivity switch. Standard 3" case. Available in kit form as 327A-1. *Weight:* .63 lb.



The DN-101 Doppler Radar Navigation System is a high accuracy, dead reckoning system of navigation achieved by measuring the Doppler shift of three beams of X-band energy directed to the earth's surface. Designed specifically for airline service, the DN-101 permits full dual system operation from a single antenna through less than four square feet of radome area. Ground speed and drift angle are determined to approximately 1 percent and 1/2 degree. The NC-103 Navigation Computer System presents "along-track" distance and "across-track" deviation information on a control panel and provides outputs for display on horizontal situation or plan view indicators. DN-101 *Weight*: 56.5 lbs.

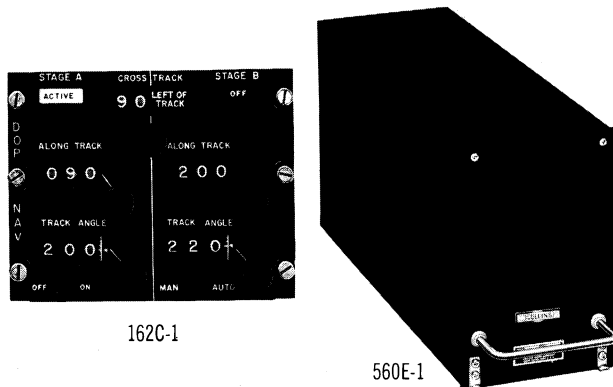
DN-101 DOPPLER RADAR NAVIGATION SYSTEM — An FMCW system is utilized in the DN-101 to overcome transmitter-receiver leakage and system vibration effects. Frequency coherency in the system assists in providing sufficient sensitivity margin for system operation under all conditions of flight and of system degradation due to accumulated flight time. Single sideband techniques are employed using the third sideband of the FMCW wave. Operates effectively to zero altitude. System design is such that the energy in the third sideband can be optimized so that nearly all of the energy of the 2 watt transmitter is contained in the upper and lower third FM sidebands. The DN-101 is immune to interference from high power search radar.

The panel mounted 338B-1 Indicator provides a continuous indication of drift angle and ground speed.

The Janus technique, applied after tracking, is used to cancel aircraft pitch and roll errors. Microwave energy is applied to three beams on a time shared basis. The feedhorn system of the lens antenna has the proper illumination taper for desired side lobe suppression and is able to feed two Doppler systems simultaneously through one lens. The metal of the horn and the lens is common to the two systems. High gain conical beams established by the lens type antenna provide high system gain and low sea state bias errors. The DN-101 contains only 6 tubes and 55 transistors. Automatic acquisition trackers eliminate the requirement for slewing. Tracking discriminators are automatically recalibrated every 14 minutes. *Power Consumption*: 250 watts ac, 12 watts dc.

NC-103 DOPPLER NAVIGATION COMPUTER SYSTEM — Ground speed and drift angle from the DN-101 is processed in the computer along with compass inputs and pilot-selected ground track data and presented on a readout control panel. Provisions are made to supply output data to auxiliary panel display indicators as well as autopilot control signals.

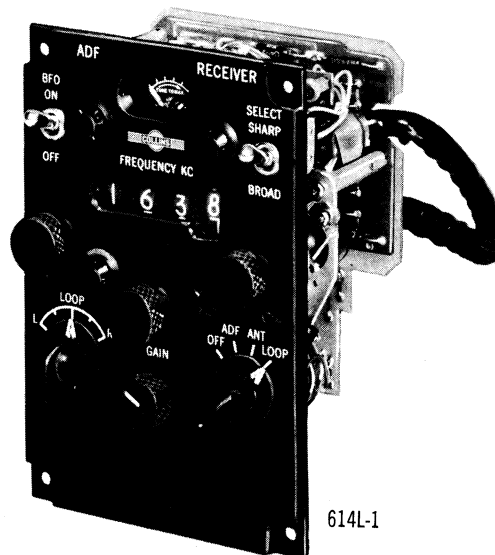
The 560E-1 Computer is an analog computer which accepts selected track, ground speed and drift angle information. This information is integrated to provide "along-track" and "across-track" data to the integrally lighted dual stage 162C-1 Control. 162C-1 readout limits are 999 nautical miles "along-track" and 99 nautical miles "across-track." *Power Requirements*: 115 v, 400 cps, normal — 120 watts, start — 180 watts. No dc required.



	Type	Dimensions (inches)			Weight (lbs.)
		W	H	D	
Transmitter/Receiver	621C-1	3/8 ATR short			11.5
Computer Tracker	562F-1	1/2 ATR			25.0
Antenna	137Y-1	21 dia. 17			17.0
Indicator	338B-1	3" standard			2.5
Control	714G-1	5 3/4	1 7/8	2	0.5
Computer	560E-1	1/2 ATR short			18.0
Control Panel	162C-1	5 3/4	4 1/2	5	5.0
Dual Antenna	137Y-2	21 dia. 17			20.0



614L-2



614L-1

The DF-202 Automatic Direction Finder System consists of a single conversion superhetrodyne receiver housed in a long 1/2 ATR case with 2 precision remote tuning controls, a flush or semiflush mounted, sealed loop antenna and an antenna coupler. Features include RF input circuitry to match the high capacitance sense antennas, Mechanical Filters for sharp selectivity, couplers and line simulators to further match the receiver to the varied sense antenna systems, use of silicon diodes, dry disk rectifiers and transistors to reduce tube count, modular construction, many test points to facilitate maintenance and no mechanical connection between tuning head and receiver.

51Y-3 RECEIVER — The 51Y-3 has a frequency range of 90 to 1800 kc in four bands. Bandswitching is performed remotely and automatically by the 100's knob on the control. Only eleven vacuum tubes of four types are used. A front mounted blower is available for extremely high environmental temperatures. All cases are compatible with ARINC cooling. The 51Y-3 operates with a 3,000 mmf sense antenna input.

137A-2 ANTENNA — The 137A-2 is a hermetically sealed

flush or semiflush mounted antenna which is electrically and physically interchangeable with conventional ADF loops. The rotating loop on the 137A-2 Antenna may be removed for servicing without disturbing the corrector settings. Ferrite correctors provide for quadrantal error correction.

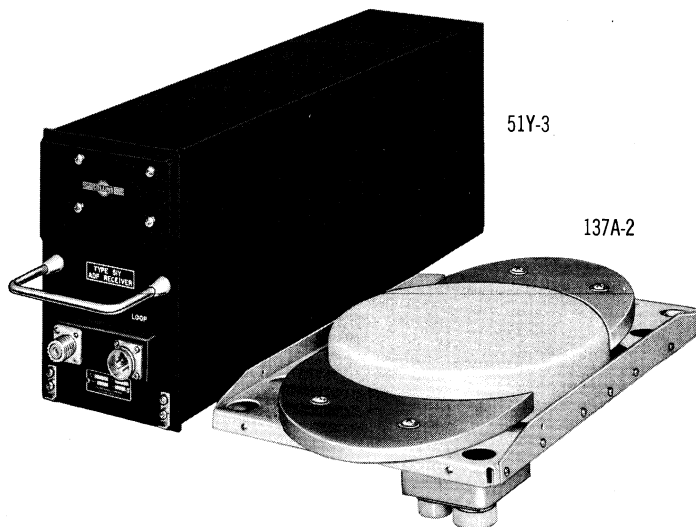
614L REMOTE CONTROLS — Allow remote frequency selection by use of a high precision, self-balancing bridge network to provide a digital frequency presentation.

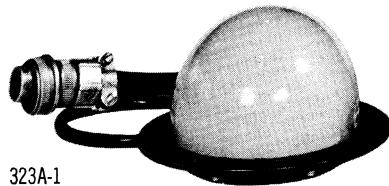
When the tuning knobs are moved, an error signal is coupled to the receiver, amplified and used to tune the RF section of the receiver. The 614L-4 is similar to the 614L-1, but has provision for ATC Transponder controls; 614L-5 same as 614L-2 with the addition of special connectors and mounting bracket; the 614L-6 is identical to the 614L-2 but has step-stops on the left-right switch. The 614L-1B has ADF receiver transfer switching.

179J-1, -2 — Transforms flush sense antenna impedance to the proper value to match the 51Y-3. The 179J-3 couples 51Y-3 to standard 270 mmf antenna system. The 316A simulates coaxial line. The 179J and 316A are designed for specific system parameters.

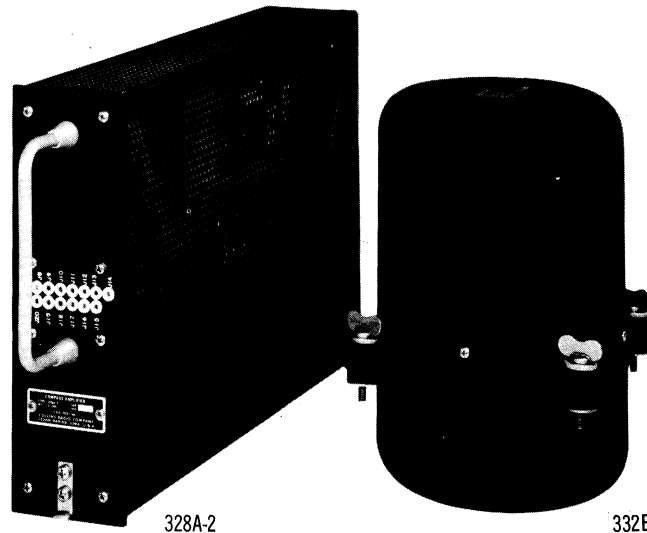
	Type	Dimensions (inches)			Weight (lbs.)
		W	H	D	
Control	614L-1, -1B, -4	4½	6½	4¼	2.6
Control	614L-2, -6	5¾	4½	4¼	2.6
Control	614L-5	5¾	4½	5⅝	2.8
Receiver	51Y-3*	½ ATR			20.3
Antenna	137A-2	9⅞	16⅞	4¼	8.4
Antenna Coupler	179J-1, -2	4½	4½	3	1.4
Antenna Coupler	179J-3	2	1⅞	1¾	0.5
Line Simulator	316A	4	2	1¾	0.3

*349D-1 Shockmount





323A-1



328A-2

332E-2

The MC-102 is a lightweight, gyro-stabilized airborne magnetic compass. The system provides $\pm 1.0^\circ$ of accuracy. Initial automatic slaving at 360° per minute rapidly synchronizes the DG with the earth's magnetic field. After synchronization, the system changes to normal slaving speed of 2 to 3 degrees per minute. *Power Requirements:* 115 v, 400 cps, start — 88 va, run — 65 va; 27.5 v dc, start — 24 watts, run — 5 watts.

328A-2 COMPASS AMPLIFIER — Includes three high power synchro transmitters with the optional addition of a fourth. Provides adequate power sources to drive an automatic pilot, flight director, Doppler and other flight and navigation systems. Has module test points on the front of the $\frac{1}{4}$ ATR short case.

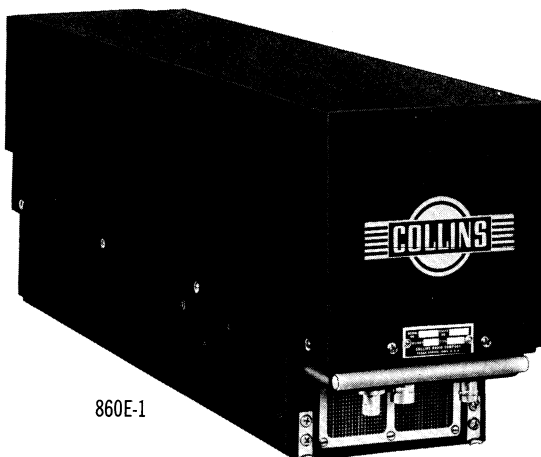
332E-2 DIRECTIONAL GYRO — Automatic fast slave or manual slave gyro with controlled tumbling in the pitch-and-roll axis and 360° freedom in the turn axis. Erection is provided by curved mercury switches and torque motor. *Erection Rate:* 4 to 8° per minute near level.

323A-1 FLUX DETECTOR — Senses direction of the earth's

magnetic field. Compensator is available where hard iron deviation is of undesirable magnitude.

327C-1 SLAVE INDICATOR — Monitors synchronization of the DG and Flux Detector. Indicates direction of correction during manual slaving; automatic slave and power monitor during automatic operation. Slave switch controls automatic slaving or manual slaving in either direction.

	Type	Weight (lbs.)	Dimensions (inches)			Shockmount
			W	H	D	
Flux Detector	323A-1	1.3	$3\frac{3}{8}$	$4\frac{3}{4}$	$4\frac{3}{4}$	.....
Compass Amplifier	328A-2	7.5	$\frac{1}{4}$ ATR short			390D-4
Directional Gyro	332E-2	5.5	$4\frac{1}{2}$	$4\frac{7}{8}$	$4\frac{7}{8}$	350X-1
Slave Indicator	327C-1	0.3	$1\frac{1}{4}$ Inst.			Panel mount
Slave Switch	.....	0.2	$2\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{2}$	Panel mount



860E-1

Collins 860E-1 Distance Measuring Equipment, TACAN, provides precise distance information for aircraft up to 200 nautical miles from an associated ground beacon. The power amplifier provides 1 kw minimum peak pulse power.

Autopositioner® tuning selects one of 126 channels, 1 mc wide in the 1025 through 1150 mc range for transmitting distance interrogation pulses. It tunes the receiver from 962 through 1024 mc or 1151 through 1213 mc. Interrogation pulses are transmitted with random timing so that the system will only lock on pulses replying to its own interrogation. Will lock on and track up to 1800 knots. *Frequency Control:* Direct crystal. *Altitude:* 30,000 feet. *Weight:* 35 lbs. *Transmitter Frequency Stability:* 0.007%. *Receiver Sensitivity:* -90 dbm. *Accuracy:* .17 mile or .2% of the distance measured. *Search Time:* 22 sec., maximum.

339D-1 DISTANCE INDICATOR — Digital mileage readout of DMET output on integrally lighted instrument requiring $1\frac{3}{8}$ " x $3\frac{1}{4}$ " panel space.

37R-1 VHF COMMUNICATION ANTENNA — A vertically-polarized communication antenna for both transmitting and receiving. Frequency range is 118.0-136.0 mc with a standing wave ratio of 2:1 or less. Impedance is 52 ohms into unbalanced line. FAA certificated.

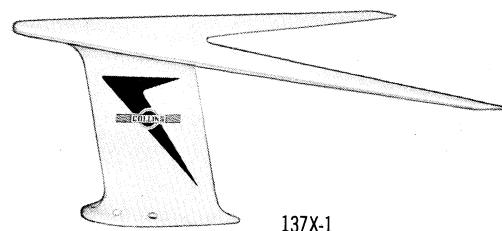
37J-3 VOR NAVIGATION ANTENNA — Horizontally-polarized antenna for receiving VOR and localizer signals. Frequency range is 108-122 mc with a standing wave ratio of 5:1 or less. Impedance is 52 ohms into unbalanced line. It will withstand more than 150 lbs. sideward pressure. FAA certificated. *Base Plate: 7¼" L, 3¾" W.*

137X-1 COMMUNICATION-NAVIGATION ANTENNA — Provides a combined antenna with essentially the same electrical characteristics as the 37J-3 and 37R-1. Designed to withstand the forces encountered at Mach .9 at sea level in an attitude of 5° pitch and 5° yaw. Passes salt spray tests. With adaptor plate, mounts same holes as 37J and R. Standard mounting plate recommended for new installations. FAA certificated. Also passes Mil. Spec.

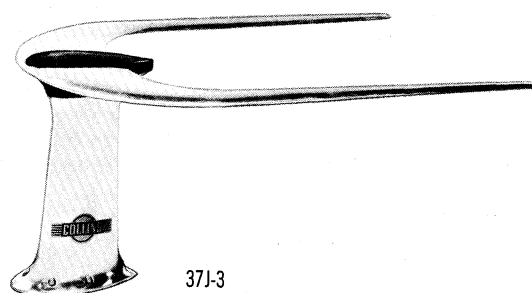
37R-2 VHF COMMUNICATION ANTENNA — A vertically-polarized communication antenna for receiving and transmitting with a maximum input capability of 125 watts. A voltage SWR of 2:1 or less is obtained over the frequency range of 116 to 152 mc. The nominal input impedance is 52 ohms. On new installations, a mounting pattern longer than the present 5⅝" pattern is recommended. For direct replacement of the 37R-1, an adapter plate is available. FAA certificated.

37X-2 MARKER BEACON ANTENNA — A horizontally-polarized antenna for receiving the 75 mc marker beacon signal. The standing wave ratio is 3:1 or less through operating temperature range: -40°C to +70°C. Impedance is 52 ohms into unbalanced line. FAA certificated.

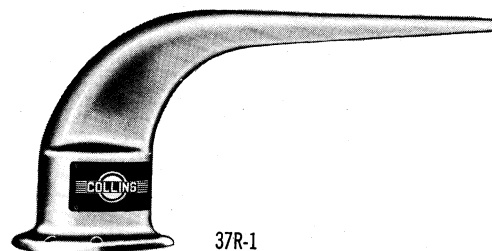
37P-4, -5 GLIDESLOPE ANTENNA — A horizontally-polarized antenna for receiving glideslope signals. It has a standing wave ratio of 3:1 or less from 329 to 335 mc at room temperature. Impedance is 52 ohms into unbalanced line. Constructed of aluminum. FAA certificated. Passes water submersion tests at an altitude of 70,000 feet and salt spray test. The 37P-5 has two inputs for dual glideslope receiver installation. Passes Mil. Specs. *Baseplate: 4½" L, 2" W.*



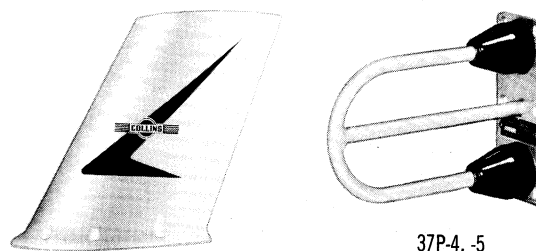
137X-1



37J-3

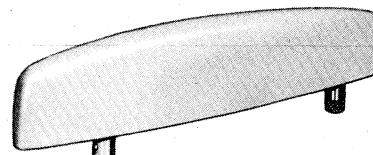


37R-1



37R-2

37P-4, -5



37X-2

Type	Dimensions (inches)			Weight (lbs.)	Drag 250 mph	Frequency Range
	W	H	D			
37J-3	17¼	12	27	4.0	2.6	108-122 mc
37R-1	3¾	10½	21⅞	3.5	1.0	118-136 mc
37R-2	3¾	12¾	11½	2.0	0.5 1.3*	116-152 mc
137X-1	10⅞	24¼	25⅞	4.7	2.7 15.3**	118-136 mc Comm. 108-127 mc Nav.
37X-2	1⅝	2¾	11⅝	1.0	3.5 oz.*	75 mc
37P-4	2	6	4½	0.7	negligible	329-336 mc
37P-5	2	5⅓	4½	0.7	negligible	329-336 mc

*at 400 mph **at 600 mph

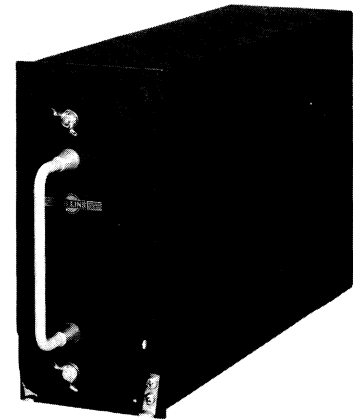
Selcal provides for calling of a single flight on two separate frequencies or single flight and group calling on a single frequency. Ground units provide for control of the calling transmitter. Tones are designated A to M (I omitted) and flights may be assigned a combination of four letters.

456C-1 AIRBORNE SELCAL — Twelve resonant reed relay assemblies in each of two channels are contained in a $\frac{3}{8}$ ATR short case. Eight switches on the front panel select the code assigned for the two channels. A cover protects against accidental change of position. Operates without pressurization to 30,000 feet. *Weight:* 10.25 lbs. *Power Requirements:* 115 v, 300-1000 cps, 15 va; 27.5 v dc, .65 amp; external B+ supply possible. *Shockmount:* 349H-2.

288A-1 TONE GENERATOR — Used in conjunction with a communication transmitter as part of a ground-to-air selective calling system. The Tone Generator is mounted in a fixed station rack and used to modulate a transmitter with the tones selected by the tone generator control units. The 12 tone oscillators of the 288A-1 may be used in any of the sequences listed in ARINC 531. Occupies $8\frac{1}{4}$ " vertical rack space.

614J-1, K-1 CONTROL UNIT — Rack mounted pushbutton control for selection of codes and keying of transmitter. The 614K-1 is console mounted.

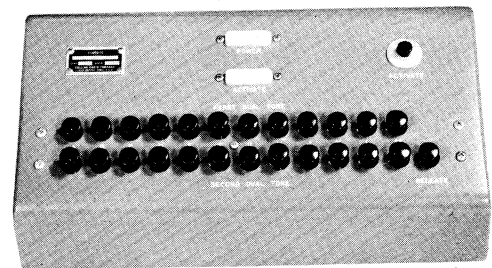
278H-1 CONTROL PANEL — Provides for 20 preset code sequences. A memory drum accessible from the front is set to any desired code. Rack mounted.



456C-1



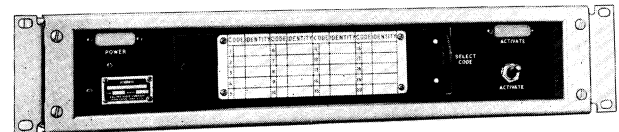
288A-1



614K-1

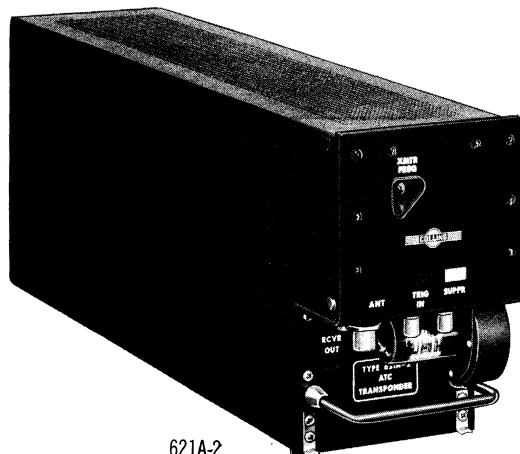


614J-1



278H-1

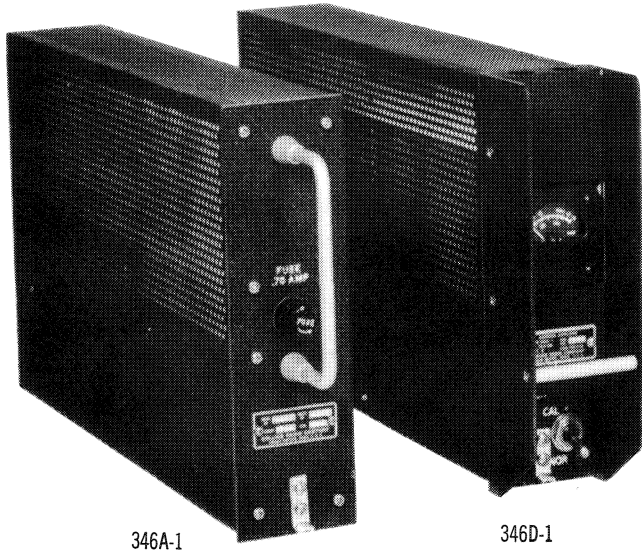
ATC TRANSPONDER



621A-2

The 621A-2 Transponder, operating in conjunction with ATC ground radar, provides a signal which reinforces radar replies, permitting a positive identification of aircraft despite rain clouds, ground clutter or operation near the maximum range of the radar. A pair of time spaced pulses transmitted on 1030 mc to the 621A-2 Transponder in the aircraft causes a reply to be transmitted on a frequency of 1090 mc. Four different modes of interrogation are accommodated. Choice of 64 different coded replies, which may be selected by the pilot using a control unit. A special identification pulse may be transmitted immediately following the code reply. Housed in $\frac{1}{2}$ ATR case weighing 26 lbs. *Frequency Control:* Transmitter — Stabilized cavity oscillator. Receiver — Crystal controlled. *Power Requirements:* 115 v, 300-1000 cps, 150 va. *Modes of Interrogation:* 8, 17 or a choice of 19, 21, 23 or 25 usec. spacing. *Shockmount:* 350E-D3.

AUDIO AMPLIFIERS



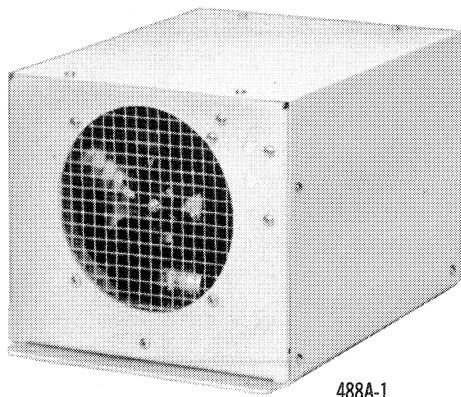
346A-1

346D-1

346A-1 INTERPHONE AND ISOLATION AMPLIFIER — Provides a complete audio system with a flexibility to meet the needs of most aircraft. It uses three different plug-in transistorized modules on the chassis-frame (which will accommodate six) to provide interphone, isolation and speaker amplifier functions. Combinations may be made up from the 356C-1 Isolation and Interphone Module, 356D-1 Amplifier Module (2 watt), 356F-1 Speaker Amplifier (10 watt) Module. Power drain of each 356C-1 is .08 amp at 27.5 v dc; of 356D-1 is .015 to .165 amp; of 356F-1 is .035 to .650 amp at 27.5 v dc. Weighs 7 lbs. or less. $\frac{1}{4}$ ATR short. *Shockmount*: 390D-1.

346D-1 PASSENGER ADDRESS AMPLIFIER — A completely transistorized high fidelity amplifier with less than 7% distortion at 40 watts of sine wave output. It provides inputs for pilot, stewardess and a tape reproducer. A multi-position tone control is provided for Treble Cut, Bass Boost and Bass Cut. Operates to 45,000 feet at -40° to $+70^{\circ}$ C. Multiple impedance output is also provided. Convection cooled. Integral dc power supply. Requires approximately 25 watts of 27.5 v dc for normal voice service; none on standby. Weighs 9.6 lbs. $\frac{1}{4}$ ATR short. *Frequency Response*: 100 to 7,000 cps with less than 3 db variation, 5 db to 10,000 cps. *Distortion*: 7% maximum at 40 watts of output, 5% at lower levels. *Tone Control*: Treble Cut (ground and flight) — 0, 5, 10, 15 db at 7500 cps; Bass Boost — 0, 5, 10 at 100 cps (music only); Bass Cut (voice only) — 0, 5, 10, 15 db at 100 cps. *Output Impedance*: 25, 50, 125, 200, 350 or 500 ohms unbalanced. *Sidetone Output*: 600 mw at rated output (adjustable). *Shockmount*: 390D-9.

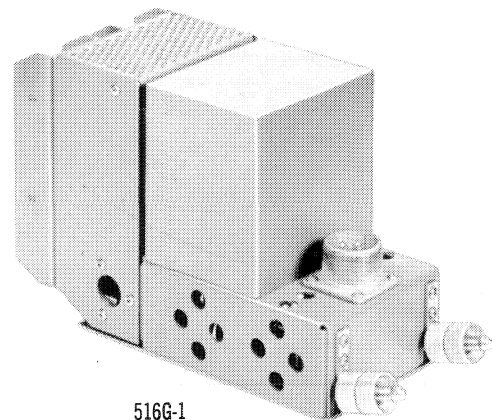
INVERTER



488A-1

The 488A-1 is lightweight, transistorized inverter with no primary rotating parts. At 55° C, supplies 250 va of 115 v, 400 cps power from a 27.5 v dc supply. Contains self protecting circuitry for line transients. Will supply 170 va continuously at 70° C. Frequency maintained within 5%. 60% efficient. Requires no preventative maintenance. Has sufficient reserve capacity to insure blowing the fuse in the event of a short in the unit when the inverter is already under full load. *Weight*: 9.25 lbs. *Size*: $6\frac{3}{4}$ " W, $9\frac{3}{4}$ " L, $5\frac{5}{8}$ " H. Requires 4 to 25 amps of 27.5 v dc depending on load. Fourteen transistors are used.

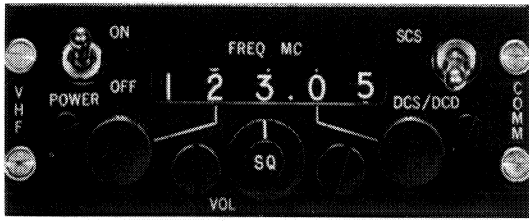
CONVERTER



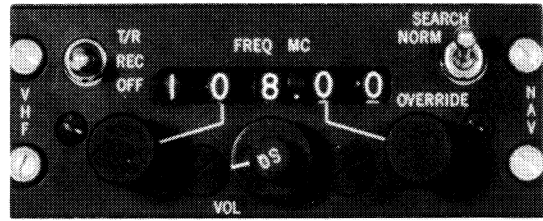
516G-1

A lightweight transistorized power converter, the 516G-1 allows aircraft with 12 volt systems to be fitted with 27.5 volt equipment. Provides 10 amps continuous and 15 amps intermittent. Absence of moving parts insures long periods between overhauls. Preventative maintenance is unnecessary. Drain is proportional to load and is zero at no load. Overall efficiency 80% or greater. Operates to 30,000 feet. Noise filters incorporated. Four power transistors are used with two high current silicon rectifiers. *Weight*: 7 pounds. *Size*: $9\frac{1}{8}$ " D, $3\frac{3}{4}$ " W, $5\frac{1}{8}$ " H. Approved under FAA TSO. Convection provides adequate cooling.

REMOTE CONTROL UNITS



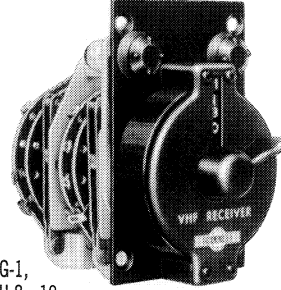
614U-1, -2, -3, -4



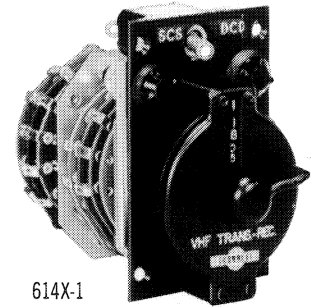
614U-7



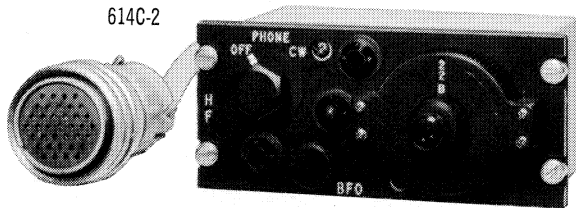
314S-4



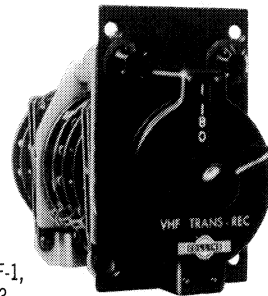
614G-1,
314U-8, -10



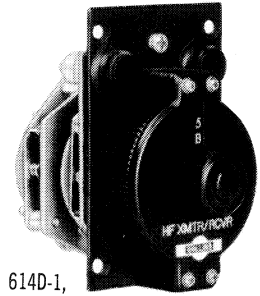
614X-1



614C-2



614F-1,
-2, -3

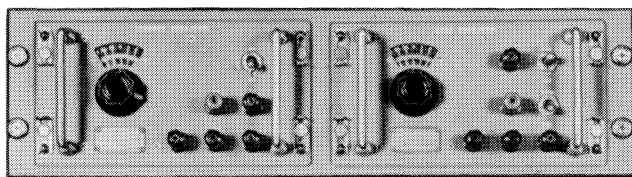


614D-1,
-2, -3

Type	Remote Control for —	Range (50 kc Steps)	Mounting	Type	Remote Control for —	Range (50 kc Steps)	Mounting
614U-1, -2	51X-2, 17L-7 combination	118.0 - 151.95 mc	Console	614D-1	618S	144 Channels assigned	Panel
614U-3, -4	51X-2 or 51R-4, 51V-3, 344B-1 or 344A-1 combination	108.0 - 151.95 mc 329.3 - 335 mc	Console	614D-2	618S	Band selection 144 frequencies	Panel
614U-7	51R-4 or 51X-2, 51V-3, 860E-1 and 344B-1 or 344A-1	108.0 - 151.95 mc 329.3 - 335 mc 126 DMET channels	Panel	614D-3	618S, contains switching contacts to prevent tune-up radiation**	Band selection 144 frequencies	Panel
614F-1	51X-1, 17L-4, -6 or 51X-2, 17L-7 combinations	118.0 - 135.95 mc	Panel	614G-1	51X-1	118.0 - 135.95 mc	Panel
614F-2	51R-3, 17L-4, -6 combination	108.0 - 135.9 mc*	Panel	314U-8	51V-2, -3; 51R-3, -4; VOR 101, 102; DME	108.0 - 135.95 mc 329.3 - 335.0 mc	Panel
614F-3	Simplex control of 17L-4, -6, 51R-3 and 51V-2, -3 combinations	108.0 - 135.9 mc* 329.3 - 335.0 mc	Panel	314U-10	51V-2, -3; 51R-3, -4; VOR 101, 102; DME	108.0 - 135.95 mc 329.3 - 335.0 mc	Panel
614X-1	51X-1A, 17L-4, -6 or 51X-2, 17L-7 combinations	118.0 - 135.95 mc	Panel	614C-2	618S, provides increased function control	Based on channel assignment	Console
314S-4	18S-4A	20 channels	Operators Console	*100 kc steps. **Switching provided to connect 180L shunt capacitance on specific channels to minimize 180L tuning time.			

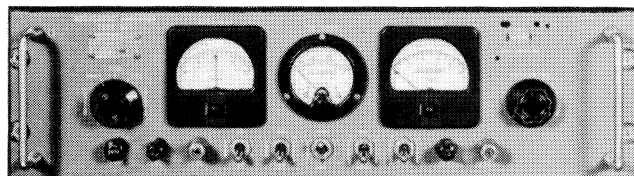
AVIATION TEST EQUIPMENT

FD-105 IFS TEST EQUIPMENT — Completely tests all important circuit parameters of the individual components of the FD-105 System. Units may be used individually or rack mounted. *Size:* (approx.): 19" W, 3½" D, 23" H.

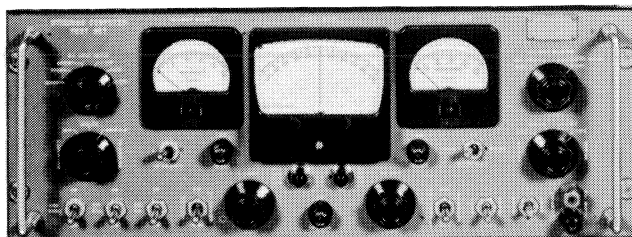


477K-1 GYRO SIMULATOR — Simulates ARINC sources. Supplies pitch and bank signals for test and adjustment of the 329B-4 series. Easily removed from rack to simulate gyro signals in the aircraft.

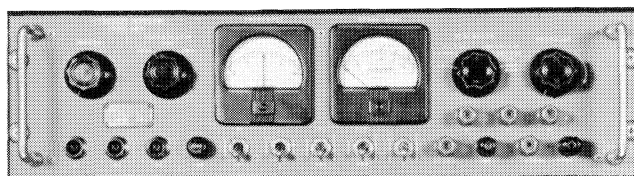
477L-1 COMPASS SIMULATOR — Simulates ARINC sources. Generates heading signals of a gyro stabilized magnetic compass. Operation of compass warning flag may be checked. May be removed from rack for simulating compass signals in the aircraft.



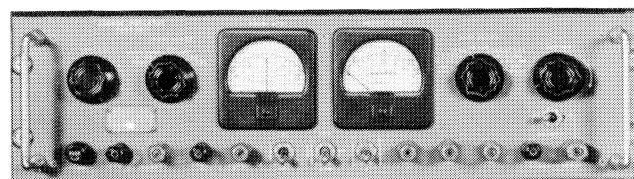
477M-1 INSTRUMENT AMPLIFIER TEST SET — Simulates signals identical to those in the 344C-1 Instrument Amplifier input circuits under actual flight conditions. Separate meters measure line currents, servo amplifier output and flag currents. Rack mounting.



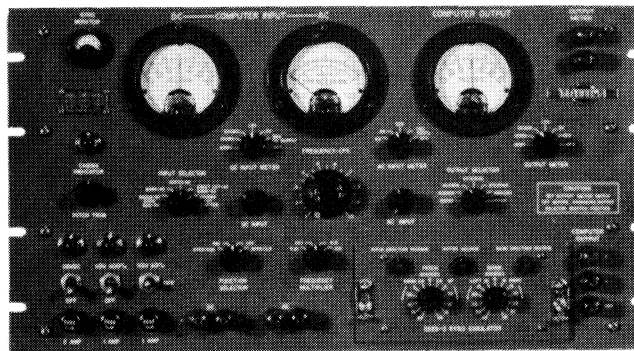
477N-1 STEERING COMPUTER TEST SET — Simulates selected heading, bank and course datum signals normally supplied to the 562A-5 Steering Computer. All important circuit functions may be tested and adjustments implemented. Complete test takes 15 min. Rack mounting.



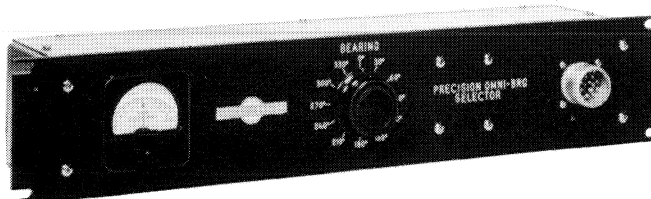
477P-1 APPROACH HORIZON TEST SET — Evaluates operational characteristics on the 329B-4 series of Approach Horizons. With the 477K-1, it provides all dc signal levels and three-wire synchro inputs normally employed in the FD-105. Rack mounting.



477Q-1 COURSE INDICATOR TEST SET — Used with 477L-1 to functionally test all operational characteristics of the 331A series Course Indicator. Rack mounting.



478C-2 FD-104 IFS TEST SET — Provides accurate simulated aircraft heading signals, lateral and vertical displacement signals, attitude signals, and rate of change of these signals as necessary for bench testing and calibrating the Collins 562A Steering Computers and components of the FD-104 IFS. Provides .001 to 10 cps signals for testing meter responses and servo mechanisms. No vacuum tubes are used. *Power Requirements:* 230 watts max. *Size:* 10½" H, 19" W, 12" D.



479V-2 PRECISION OMNI-BEARING SELECTOR — Used for a test panel for checking the 344A-1, 51R-3 and earlier navigation receivers. 30° steps selected by a tap switch with a maximum runout error of ±.05°. Tests the receiver without introducing omni-bearing selector errors. *Weight:* 5 lbs. *Size:* 3½" H, 19" W, 4" D.

AVIATION TEST EQUIPMENT

(Continued from page 25)



477U-1, 477V-1 ADF TEST SET — Provides complete test and simulator signals for the DF-201 ADF. The 477U-1 ADF Loop Simulator generates a calibrated RF field and excites a contained loop antenna. Receiver bearing indications are displayed on the front panel. The 477V-1 tests antenna, loop, ADF aural and ADF bearing sensitivity, dial calibration, bearing speed, AVC and gain control characteristics, and makes test point measurements on individual modules. *Mounting:* Rack or carrying case.



479S-3 VOR AUDIO SIGNAL GENERATOR — Used for precision testing and calibration of VOR receivers. It provides all output signals required for VOR, tone localizer and

glideslope audio circuit investigations, and for modulating a suitable RF signal generator. The unit derives all signals from electromechanical generators operated from shafts driven by synchronous motors. *Size:* 10½" H, 19" W, 14" D.

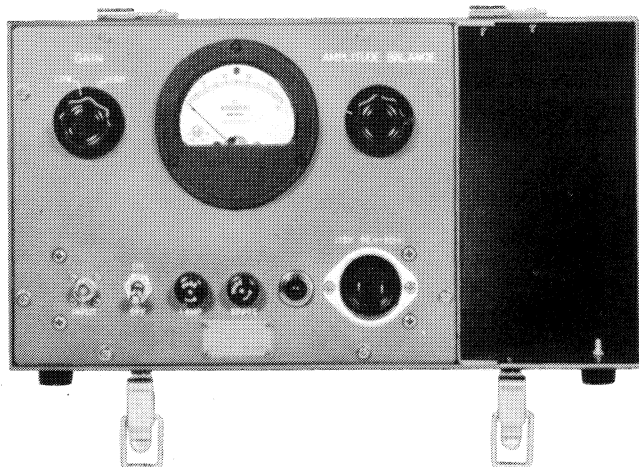


479T-2 ALL CHANNEL VOR-ILS SIGNAL GENERATOR — A portable test set for ramp testing of navigation and ILS receivers. May be used inside or outside the plane for an over-all check on the installation from receiving antenna to indicating instruments. Complete coverage of all channels from 108.0 through 135.9 and 329.3 through 335.0 mc. RF level can be varied from 4 to 200,000 microvolts. Signals include: VOR, LOC, glideslope, 1000 cps audio tone. *Size:* 19" W, 18" H, 10½" D.



479U-1 THREE CHANNEL VOR-ILS SIGNAL GENERATOR — A portable test set for ramp checking VOR/LOC

and glideslope receivers and associated components installed in the aircraft from antenna to instruments. One channel each provided for VOR, localizer and glideslope. Test antenna and cords included. *Size:* 13 $\frac{3}{8}$ " L, 7 $\frac{1}{8}$ " W, 13" D.



478A-1 ZIFOR (Zero Indicator for Omni-range) — Used for precisely ascertaining the proper zero, or North, setting on audio signal generators used in VOR testing and to set the zero on the Collins 479S series of test equipment or their equivalents. May also be used to check for phase shift through the RF signal generator. Used with the 479S-3. *Size:* 13 $\frac{1}{2}$ " H, 13 $\frac{1}{2}$ " W, 7 $\frac{1}{2}$ " D.



180M-1 ANTENNA TUNING UNIT TEST SET — A manually adjustable network used to minimize the time required to determine the circuit elements which must be wired into the 180K-3. Circuits and values of capacitance and inductance selected by front panel controls. *Size:* 7 $\frac{3}{4}$ " H, 10 $\frac{1}{4}$ " W, 9 $\frac{7}{8}$ " L.



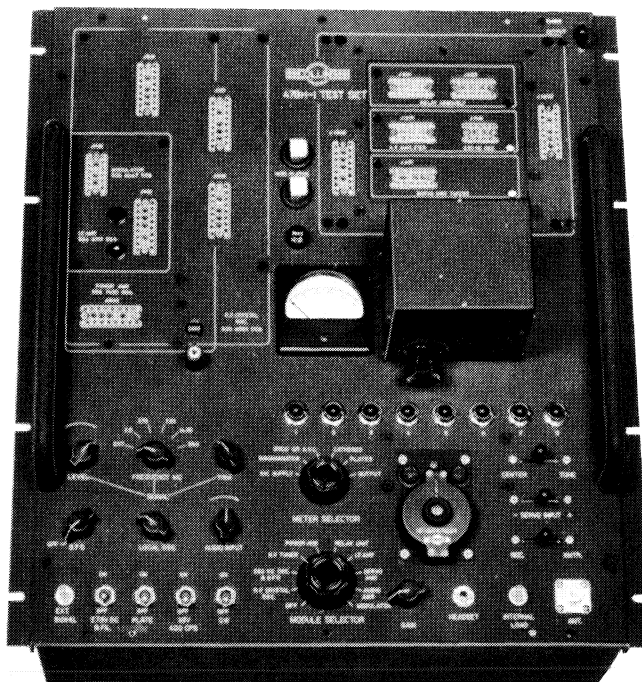
479X-2 INSTRUMENT ZEROING PANEL — Provides precision facilities for indexing VOR resolver type instruments. By means of a precision network. Gives uniform results with 51X-1A, 51R-3, 51X-2, 51X-3 and 51R-4 Collins Navigation Receivers. OBS and OBI instruments can be indexed within $\pm 1^\circ$. Rack mounting.

Designed to permit Omni-Resolver Zeroing procedures to be carried out in accordance with RTCA standards. Does not require a phase standard. Zeroed to standards recognized by RTCA SC-61. *Size:* 3 $\frac{1}{2}$ " H, 19" W, 4" D.



479V-3 PRECISION OMNI-BEARING SELECTOR — Transformer operation provides a design center track selector for the 344B-1, 51R-4, 344A-1, 51R-3, 51R-2 and 51R-1 VHF instrumentation units.

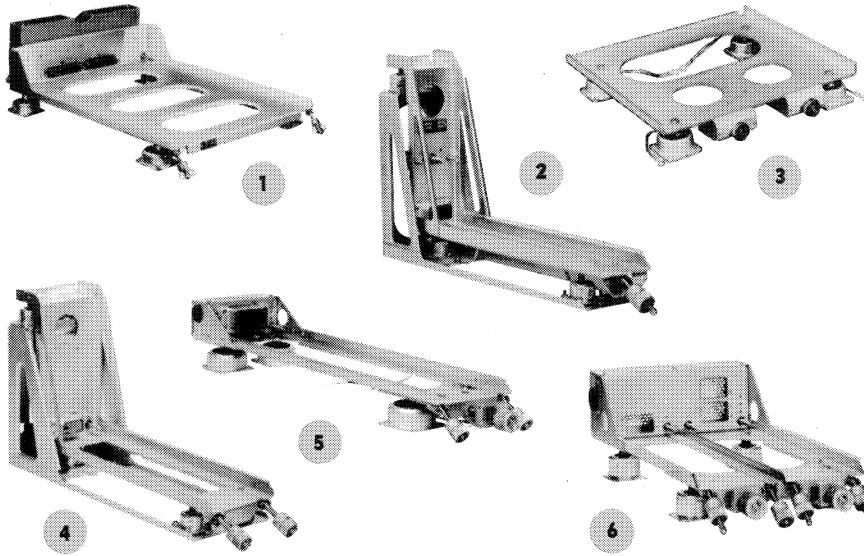
Thirty cycle or 400 cycle operation is selected by a panel switch. 30° steps selected by a tap switch with maximum runout error of $\pm .03^\circ$. *Weight:* 7.5 lbs. *Size:* 19" W, 3 $\frac{1}{2}$ " H, 6" D.



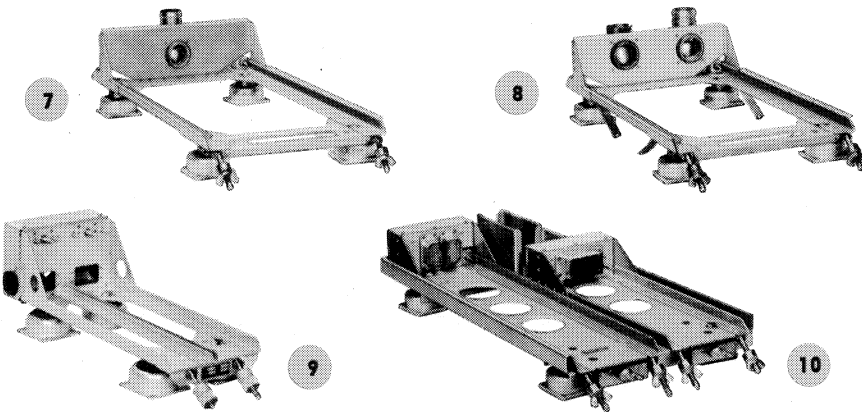
478H-1 618S TEST SET — The 478H-1 and associated 413F-1 Power Supply provide complete self-contained facilities for testing modular subassemblies of the 618S. Also provides a convenient test station for detailed circuit checks. The lower portion of the test set panel carries all operating controls required to simulate functions of the complete 618S Transceiver. *Weight:* 35 lbs. *Size:* 19 $\frac{3}{8}$ " H, 17 $\frac{1}{2}$ " W, 8" D.

413F-1 — Provides all operating voltages. 413F-1 requires 6 amps of 115 v, 1 phase, 60 cps. *Weight:* 30 lbs. *Size:* 9" H, 17 $\frac{1}{2}$ " W, 7" D.

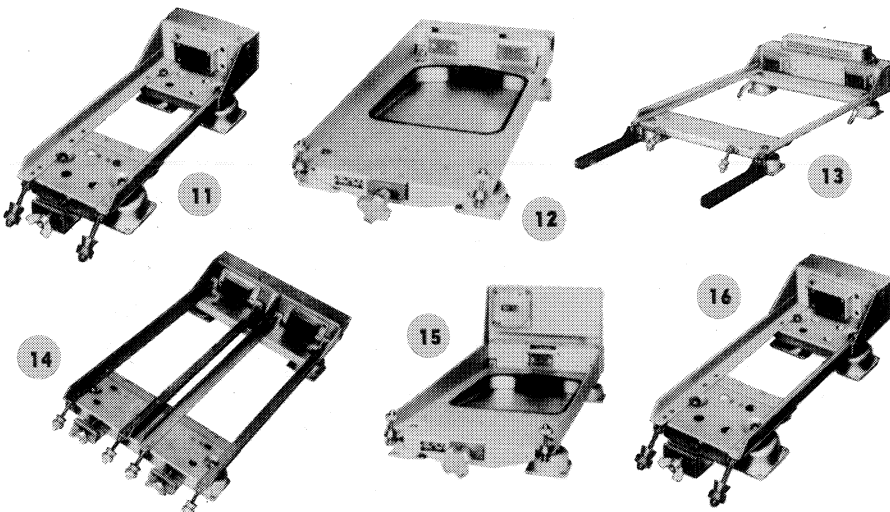
SHOCKMOUNTS



- 1. 350S-3 for 618S. Weight: 9 lbs.
- 2. Short ¼ ATR shockmount. 390D-1 for 346A-1, B-1. 390D-2 for 51Z-2. 390D-3 for 51V-3. 390D-4 for 328A-2. 390D-5 for 562A-5. 390D-6 for 344C-1. 390D-7 for 562A-7. 390D-8 for 344A-1. 390D-9 for 346D-1. Weight: 1.3 lbs.
- 3. 350D-3 for 180K, 180L. Weight: 1.25 lbs.
- 4. Short ¾ ATR shockmount. 349H-2 for 456C-1. 349H-3 for 17L-7. 349H-4 for 51X-2. 349H-5 for 344B-1. 349H-6 for 621C-2. 349N-1 for 309A-1, 309A-2. Weight: 1.5 lbs.
- 5. ½ ATR shockmount. 349D-1 for 51Y-1, -3. 349D-3A for 51R-4. 350E-3A for 51R-3 or 351A-1. 350E-3C for 17L-4, -6. 350E-3D for 621A-2. 350V-1 for 562C-1A. Weight: 2.2 lbs.
- 6. Dual short ¾ ATR shockmount. 390E-1 for 51X-2 and 344B-1. 390E-2 for 51X-2 and 17L-7. Weight: 2.5 lbs.



- 7. 1 ATR shockmount. 349E-3 for 618C-3. 349F-4 for 548D-3. Weight: 5 lbs.
- 8. 1 ATR shockmount. 349F-5 for 548D-4. 390J-1 for 618T-2. Weight: 5 lbs.
- 9. Dual short ¼ ATR shockmount. 390F-1 for dual 51V-3. 390F-2 for 51V-3 and 51Z-2. 390F-3 for 346A-1 and 51V-3. 390F-4 for 346A-1 and 51Z-2. 390F-5 for 562A-5 and 344C-1 or 562A-7 and 344C-1. 390F-6 for 346A-1 and 346D-1. Weight: 2.25 lbs.
- 10. 349J-1 for 562A-6, 562C-1A, 614E-3 and F type Magnetic Amplifier. Weight: 7 lbs.



- 11. Short ½ ATR shockmount. 350M-1A for 562A-3A, -3B. 350M-2 for 562A-4, -4A, -4B, -4C or A-6. 390K-1 for 560E-1. 350L-2 for 51V-2. Weight: 3.7 lbs.
- 12. 349B-2 for 776C-1, -2. Weight: 4 lbs. (Available without air chamber.)
- 13. 350C-5 for 18S-4A. Weight: 7.5 lbs.
- 14. Dual ½ ATR shockmount. 350F-3 for 17L-6 and 51R-3. 350G-3 for 51R-3 and 351A-1. Weight: 4.6 lbs.
- 15. 349A-4 for 374A-1. Weight: 4.5 lbs. (Available without air chamber.)
- 16. 350T-1 for 416W-1, W-3. Weight: 3.5 lbs. 350T-3 same as above for shockmounted shelves.

SMOKE TUNNEL

The 960A-1 Smoke Tunnel provides facilities for visual investigations of airflow phenomena occurring in the study of aerodynamics.

Fine smoke filaments pass over easily inserted test models, demonstrating airstream behavior around the structure. Models may be controlled during tests to vary the attack angle or the position of one or two control surfaces.

The tunnel is of the suction type, with a centrifugal blower mounted at the end of its operational system. Air is drawn into the bellmouth and passed through three fine-mesh wire screens to reduce turbulence as it enters the silencing chamber. The flow is then accelerated into the test section through a two dimensional nozzle with a large contraction ratio.

Smoke is introduced into the flow through a vertically

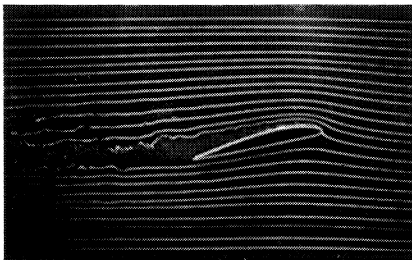
mounted smoke strut in the nozzle of the tunnel. The smoke is produced by a smoke generator and fed directly to the strut where it is released through several small protruding tubes.

As the air and smoke filaments are drawn through the test chamber, the flow patterns that are formed may be observed against black velvet background.

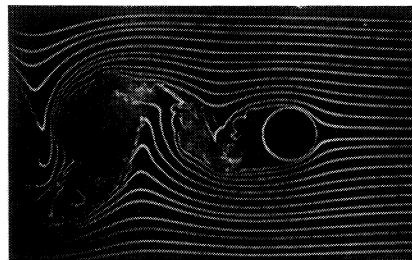
Airflow velocity is controlled by a sliding valve. Chamber is lighted by eight 75 watt bulbs. Still photography and high speed motion pictures may be used for further smoke tunnel studies. *Power Source:* 110 v ac, 15 amps. *Air Speed:* Zero to 35 fps. *Test Models Include:* Flat plate, cylinder with flat plate airfoil and movable flap, symmetrical airfoil, three-dimensional wing and wing tip. *Observation Area Size:* 36" W, 24" H, 2.5" D.



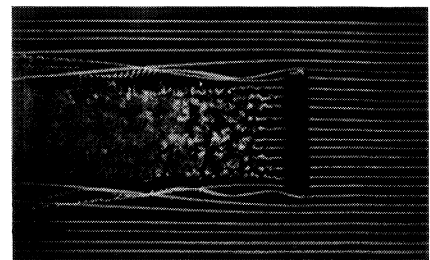
The 960A-1 in operation. Presentation is large enough for viewing by an entire classroom. Photography may be accomplished without special lens, but strobe lights or gas filled bulbs should be inserted in the test chamber to prevent glass flare.



Symmetrical section with angle of attack. Controls allow demonstration of attack angle transition from zero angle to vertical.



Airflow around a cylinder with KARMAN street vortices in the wake. High speed lighting is necessary for stop motion photography.



Three dimensional flow pattern on a straight wing. The formation of the wing tip vortices is demonstrated with this wing model.

VOR GROUND SYSTEMS

Collins VOR Systems provide complete station installations with two power sizes and single or dual transmitters. Systems comply with requirements of Annex 10 ICAO Aeronautical Telecommunication Standards. A rugged mechanical antenna design eliminates fluctuations and failures of electronic types of generators. The high inherent stability is dependent upon mechanical symmetry which is carefully controlled during the production process and does not change with time or humidity conditions. A monitor of fail-safe design provides a continuous check of the amplitude and character of the transmitted signals. If the monitored functions deviate beyond predetermined limits, the monitor transmits an alarm to the control

point and removes the transmitter from the air. The monitor is self-testing.

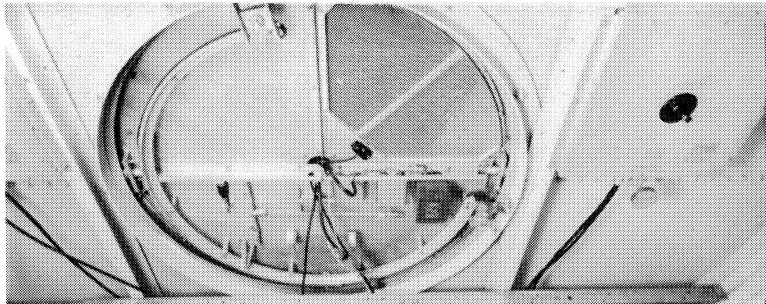
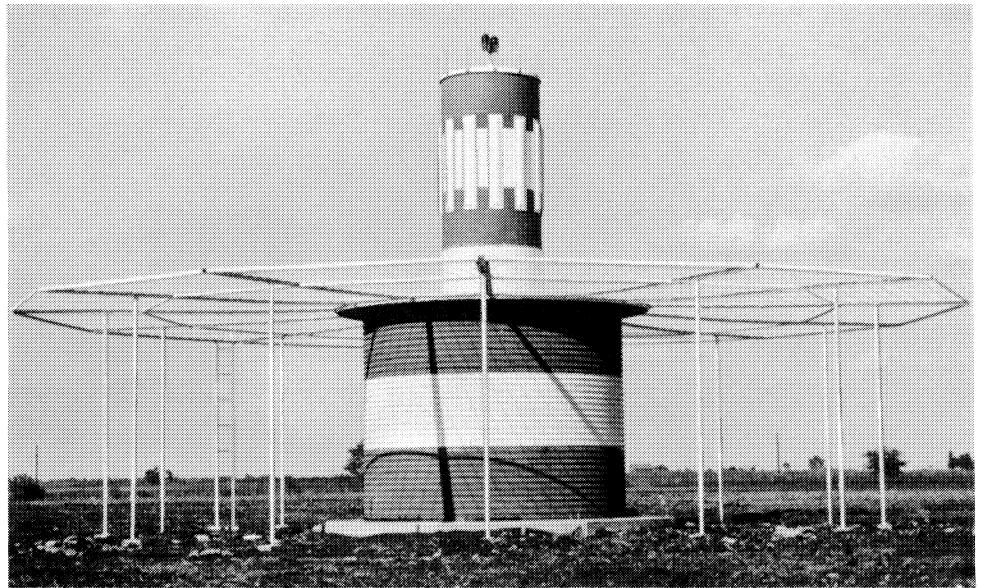
The complete basic VOR installation consists of a VHF transmitter and precision modulation system together with an antenna system designed for efficient radio frequency radiation with a specific pattern. All equipment except the antenna, monitor antenna, and remote control unit is housed in a special prefabricated enclosure, the roof of which serves as a ground plane for the antenna. Facilities are included to measure the transmitted bearing accuracy in eight directions, without the use of an external phase standard.

OR-102 — The basic VOR system includes a prefabricated steel shelter with VOR antenna and counterpoise, a 50 watt 242F-5 VHF Transmitter, modulation eliminator, local control unit, keyer oscillator, relay power supply, VOR monitor and monitor antenna, equipment rack and cable assembly, house wiring kit and a sound powered handset.

OR-202 — This 50 watt system is the same as the OR-102, but it provides dual transmitters and automatic switchover in the event of equipment failure.

OR-302 — This system differs from the basic OR-102 in that it has a 200 watt 242F-2 Transmitter.

OR-402 — A dual 200 watt transmitter and automatic switchover system is the only difference between this system and the OR-302.



Above. Convenient access to antenna interior is through screened hatch. The eight point bearing check may be made without leaving the house by turning the outer shell with crank supplied.

Right. The OR-202 installation with covers removed from each unit. Ventilation blower is shown at left. Note passageway space available.

Far right. View through antenna house door showing equipment with covers installed.

