$12.00 U.S.

PILOT'S GUIDE FOR THE

TACAN

TACTICAL AIR NAVIGATION SYSTEM

MODEL AN/ARN-154(V)

L3 communications

TACAN ADVANTAGES

LIGHTER, SMALLER, PROVEN

The L-3 airborne Tactical Air Navigation (TACAN) transceiver, model RT-1634(V), part of the AN/ARN-154(V) TACAN system, is the world's lightest and smallest TACAN transceiver ever produced weighing in at 6.5 pounds. We've used our 15 years of TACAN experience to make the AN/ARN-154(V) the only multi-station TACAN tracking system in the world. The system can track the range of four TACAN or Distance Measuring Equipment (DME) ground stations and the bearing of two TACAN ground stations simultaneously. The system can also conduct air-to-air operations.

COMPATIBLE

The AN/ARN-154(V) consists of the RT-1634(V) transceiver, an optional L-3 control unit (such as the F3849), up to 10 optional L-3 indicators [such as the ID-2502(V)], and one or two customer-supplied L-band antennas. If you prefer, you can use your own compatible tuning and display devices with the RT-1634(V), such as Horizontal Situation Indicators (HSIs), Electronic Flight Instrument Systems (EFISs), Flight Management Systems (FMSs), and Very High Frequency (VHF) Omnidirectional Radio (VOR) receivers to name a few.

DEVELOPED FOR THE MILITARY ENVIRONMENT

Designed with rugged military environments in mind, every RT-1634(V) produced is subjected to Electronic Stress Screening (ESS) per MIL-STD-781D to achieve maximum system reliability. The RT-1634(V) has exhibited an actual in-service Mean Time Between Failure (MTBF) in excess of 3,500 hours, and in some cases up to 6,200 hours.

MISSION FLEXIBILITY

Some versions of the RT-1634(V) interface with analog flight instruments. Other versions accept Aeronautical Radio Inc. (ARINC) 429 digital tuning inputs, and output ARINC 429 digital data. The RT-1634(V) can also be easily adapted to meet virtually any military interface requirement at minimum cost.

$12.00 U.S.

PILOT'S GUIDE FOR THE

TACAN

TACTICAL AIR NAVIGATION SYSTEM

MODEL AN/ARN-154(V)

Designed and manufactured in the United States of America by

L-3 Communications Avionics Systems, Inc.
5353 52nd Street, S.E.
Grand Rapids, MI 49512 USA
(800)253-9525 or (616)949-6600
Fax (616)285-4224
www.L-3com.com/as

IMPORTANT NOTICE

This is not a stand-alone operating manual for your TACAN system. Refer to your Aircraft Flight Manual (AFM) and Aircraft Flight Manual Supplement (AFMS) for information specific to your aircraft. If there is conflicting information between those manuals and this pilot's guide, the AFM and AFMS take precedence over this pilot's guide.

REVISION HIGHLIGHTS

This revision B of the pilot's guide makes the following changes:

- Changes occurences of "Goodrich Avionics Systems" to "L-3 Communications Avionics Systems" or just "L-3 Avionics Systems" and makes related company contact information changes. (On March 28, 2003, Goodrich Corporation sold its Avionics Systems division to L-3 Communications Corporation.)
- Adds a statement on page 2-4 that it may take up to 2 minutes after the RT-1634(V) locks onto a ground station's signal before the indicator displays the ground station's ident.
- Adds a statement on page 3-3 that the aircrew is required to positively identify the tuned ground station by listening to the morse code ident from the station.
- Adds Revision Highlights section.

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LIST OF TABLES

ABBREVIATIONS & ACRONYMS

2X5	ARINC 410 two out of five code (2/5)
A/A	Air-to-Air mode
A/G	Air-to-Ground mode
ADF	Automatic Direction Finder
AFMS	Aircraft Flight Manual Supplement
AGL	Above Ground Level
ARINC	Aeronautical Radio, Inc.
ATC	Air Traffic Control
BCD	Binary Coded Decimal
BDHI	Bearing & Distance Horizontal Indicator
CDI	Course Deviation Indicator
CSDB	Collins Serial Data Bus
DME	Distance Measuring Equipment
EFIS	Electronic Flight Instrument System
ESS	Electronic Stress Screening
FAA	Federal Aviation Administration
FMS	Flight Management System
FPD	Flat Panel Display
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
HSI	Horizontal Situation Indicator
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
kn	Knots
LF	Low Frequency
LORAN	Long Range Navigation
LOS	Line Of Sight
MF	Medium Frequency
MDP	Mission Display Processor
MFD	Multi-Function Display
MTBF	Mean Time Between Failures
navaid	Navigation Aid
NDB	Nondirectional Beacon
nmi	Nautical Miles
NVG	Night Vision Goggle
RF	Radio Frequency
RNAV	Area Navigation
RMI	Radio Magnetic Indicator
RTCA	Requirements & Technical Concepts for Aviation
SRNS	Satellite Radio Navigation System
TACAN	Tactical Air Navigation
TSO	Technical Standard Order
VHF	Very High Frequency
VOR	VHF Omnidirectional Radio
VORTAC	Co-located VOR and TACAN facilities

CHAPTER 1
NAVAID INFORMATION

INTRODUCTION

This chapter provides basic information on how various air navigation systems, including TACAN, operate. This overview is intended to help you better understand and appreciate how the AN/ARN-154(V) can provide you with valuable navigation information when other navigation systems on your aircraft may not be able to.

AIR NAVIGATION SYSTEMS SUMMARY

The national airspace system is made up of a wide variety of air navigation facilities (referred to as *navigation aids* or simply *navaids*), each serving a special purpose in our system of air navigation. These navaids have various owners and operators, such as the Federal Aviation Administration (FAA), the military services, private organizations, individual states, and foreign governments. A specialized agency of the United Nations called the International Civil Aviation Organization (ICAO) sets international standards in its Annex 10 document for the operation and use of aviation navaids by civilian and military aircraft, but has no authority to directly regulate the navaids. The FAA has the statutory authority to establish, operate, and maintain aviation navaids in the U.S. Some of the major navaids include:

LORAN .... Long Range Navigation

GPS .... Global Positioning System

GLONASS ...... Russia's Global Navigation Satellite System

Galileo .... Europe's planned satellite navigation system

VOR................ VHF Omnidirectional Radio

NDB .... Nondirectional Beacon

MB .... Marker Beacon

ILS .... Instrument Landing System

DME .... Distance Measuring Equipment

ILS/DME .... DME used as part of an ILS

TACAN .... Tactical Air Navigation

VOR/DME ..... Co-located VOR and DME

VORTAC .... Co-located VOR and TACAN

The AN/ARN-154(V) is capable of communicating with the last five types of navaid ground stations listed above, namely: DME, ILS/DME (DME portion), TACAN, VOR/DME (DME portion), and VORTAC (TACAN portion).

Think of these navaids as being divided into three groups. One group is made up of "positional navaids." These navaids (LORAN, GPS, GLONASS, and Galileo) provide suitably-equipped aircraft with the aircraft's latitude and longitude. The second group of navaids consists of area navigation (RNAV) navaids. These navaids (VOR, NDB, DME, TACAN, VOR/DME, and VORTAC) provide suitably-equipped aircraft with position information based on bearing and/or distance to the navaid ground stations. The third group of navaids consists of specialized navaids including MBs and ILSs.

Table 1-1 shows the frequencies used by the various navaids.

Table 1-1. Navaid Frequencies

Navaid	Frequency
LORAN-C	100 kHz (LF)
NDB	190–535 kHz (LF–MF)
MB	75 MHz (VHF)
ILS Localizer	108.10–111.95 MHz (VHF)
VOR	108.0–117.95 MHz (VHF)
ILS Glideslope	329.15–335.00 MHz (UHF)
DME	962–1,213 MHz (UHF)
TACAN	962–1,213 MHz (UHF)
GPS	1,227 & 1,575 MHz (UHF)
Galileo	1,164–1,300 & 1,563–1,591 MHz (UHF)
GLONASS	1,240–1,260 & 1,602.5625–1,615.5 MHz (UHF)

Table 1-2 lists the approximate number of some of the navaids available worldwide.

Table 1-2. Number of Navaids Worldwide

Navaid Facility	Quantity
VOR	909
VOR/DME	694
VORTAC	887*
TACAN Only	389*
Total	2,879
*TACAN Usable	1,276

RNAV CALCULATIONS

Suitably-equipped aircraft can obtain bearing and/or distance information from VOR, NDB, DME, and TACAN ground stations. You can then use this information to calculate your position. The basic position calculations are described in the following paragraphs. They are listed in the order of their accuracy, best-to-worst with a paragraph at the end of this section describing how the AN/ARN-154(V) can combine these basic calculations for even better accuracy. (In this section rho means distance and theta means bearing.)

RHO-RHO-RHO POSITION

(Distance information to three stations.) Your position is defined as the intersection of the three range circles (figure 1-1). This yields one distinct location.

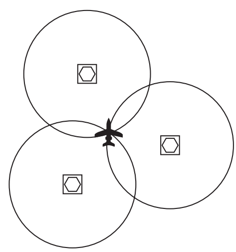


Figure 1-1. Rho-Rho-Rho Position

RHO-RHO-THETA POSITION

(Distance information to one station; distance and bearing information to another station.) Your position is defined as the intersection of the two range circles on a radial from one of the stations (figure 1-2). This yields one distinct location.

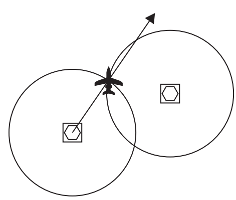


Figure 1-2. Rho-Rho-Theta Position

RHO-RHO POSITION

(Distance information to two stations.) Your position is defined as the intersection of the two range circles (figure 1-3). This of course yields two points and two possible locations. You must then use information from other navigation sensors onboard to resolve the position ambiguity.

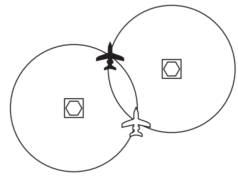


Figure 1-3. Rho-Rho Position

RHO-THETA POSITION

(Distance and bearing information to one station.) Your position is defined as the distance to the station on a specific radial (figure 1-4). This yields one distinct location.

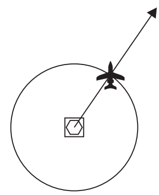


Figure 1-4. Rho-Theta Position

COMBINATION POSITION

Using the multi-station tracking capability of the AN/ARN-154(V), you could calculate your position using a combination of the basic positioning calculations, for example, if using all of the available tracking channels in the AN/ARN-154(V), you could calculate your position as the intersection of four range circles and two radials (rho-theta, rho-theta, rho-rho).

LORAN (LONG RANGE NAVIGATION)

The name LORAN is an acronym derived from the words "long range navigation." First developed during World War II for use by the U.S. Navy, LORAN-A was a medium frequency (MF) radio navigation system transmitting at 2.0 MHz. In 1957, the system was upgraded to LORAN-C, a low frequency (LF) radio navigation system transmitting at 100 kHz. The newer LORAN-C system was soon deployed in strategic areas of the globe to meet U.S. military requirements.

In 1974, the Department of Transportation selected LORAN-C as the official aid to navigation for the coastal waters of the U.S. The U.S. Coast Guard was tasked with the responsibility of operating and maintaining the LORAN system. Full civilian LORAN service for the coastal confluence zone was completed in 1980.

LORAN chains have been fielded in many foreign countries and are still being fielded today in many other countries because of their unique capabilities.

It wasn't long before enterprising aviators began using marine LORAN units unofficially in their aircraft. Recognizing the need, pioneering aviation manufacturers (like L-3 Avionics Systems) began producing LORAN receivers specifically for aviation applications.

Geometry is the heart of how LORAN works. LORAN consists of transmitting stations arranged in groups forming a LORAN chain. An aircraft equipped with a LORAN sensor passively receives and interprets the signals transmitted from the LORAN stations. To determine position, the LORAN sensor measures the time interval between the receipt of signals. From this information, the LORAN sensor plots the lines of position from each station. Intersecting lines of position determine your aircraft's position, which the LORAN sensor converts to a latitude and longitude fix. It also uses the signals it receives to calculate distances and ground speed.

GPS (Global Positioning System)

The first operational U.S. Satellite Radio Navigation System (SRNS) (Transit) was developed for the Navy in 1959. The Department of Defense began developing the current GPS system in 1973. In 1992 the FAA published performance standards for GPS receivers as supplemental navigation aids for aircraft (Technical Standard Order [TSO] C129).

GPS uses a constellation of orbiting satellites to provide extremely accurate, three-dimensional position and altitude information. The satellites orbit approximately every 12 hours at an altitude of 10,900 nmi. This arrangement places 6 to 11 satellites at 5° above the horizon (or higher) for users anywhere in the world.

The operation of the GPS system requires precise synchronization of the satellites with GPS system time. The satellites transmit signals on two L-band frequencies, 1,227 MHz and 1,575 MHz. The lower frequency is for military use. The RF signals broadcast GPS system time and ephemeris information (orbital data about the satellite that tells where it is and where it's going to be). An aircraft equipped with a GPS sensor passively receives and interprets the signals. The time it takes the signals to travel from the satellites to the sensor is used to calculate the range to each satellite. This calculation enables the GPS sensor to determine your aircraft's position and altitude.

Normally, four satellites are required for navigation and at least five are required to guarantee the accuracy of the position fix. Your position can be thought of as the intersection of at least four spheres, with a satellite at the center of each sphere. If the GPS sensor tracks less than four satellites, the altitude parameter becomes ambiguous and the system provides only position information. If less than three satellites are tracked, the position parameter becomes ambiguous.

GLONASS (Global Navigation Satellite System)

GLONASS is the Russian navigation satellite system. The experimental phase was deployed in 1982. It became fully operational with 24 satellites in the late nineties. Today, the system has ceased to be fully operational.

GLONASS operates in the L-band in two bands: 1,602.5625–1,615.5 MHz and 1,240–1,260 MHz. The satellites are in circular orbits at an altitude of approximately 10,300 nmi. The satellites provide position and velocity in real time. Some western GPS receivers use the GLONASS signals to supplement their GPS position calculations.

Galileo

Galileo is the European Union's planned satellite positioning and navigation system. Development began in 1999. It is being designed from the ground up to be a civil system more efficient, reliable, and accurate than GPS. When fully operational in 2008 the system will consist of 30 satellites in 3 orbital planes at an altitude of approximately 12,751 nmi circling the earth approximately every 14 hours.

Some advantages Galileo promises are:

- Integrity information will be transmitted globally together with the navigation signal.
- Accuracy will be guaranteed to at least 1 meter.
- Coverage area will be the entire planet including the extreme latitudes.

VOR (VHF OMNIDIRECTIONAL RADIO)

By the late 1940's the VOR system had been developed as the primary air navigation aid. The VOR system provides the airborne receiver with a radial to the station, but no distance information.

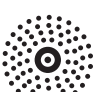
A VOR facility transmits signals outward in all directions. These signals "radiate" outward and can be thought of as 360 radials from the station, one for each degree. Each radial is identified by its magnetic heading from the VOR (i.e., the 360° radial represents magnetic north, and the 180° radial represents magnetic south, and so on).

An aircraft equipped with a VOR receiver passively receives and interprets the signals. The receiver calculates the bearing information and sends it to a navigation system display. The navigation system typically allows you to select a course to or from the station, then displays your course deviation as right or left of the course.

VORs are used for enroute navigation and as navaids for terminal approaches. Hundreds of these facilities are located throughout the world and in the U.S. to form the Victor and high altitude airway system. Using the VOR system, pilots can fly a zigzag path from one VOR station to the next, or make use of the radial information from two VOR stations to determine their location.

VORs operate on 200 possible frequencies within the 108.0 to 117.95 MHz VHF band and are subject to line-of-sight restrictions. One restriction is that the range of the signal is restricted by the curvature of the earth, i.e. the maximum range obtainable varies proportionally with the altitude of the aircraft and also depends on the type of terrain and the transmitting power of the ground station.

NDB (NONDIRECTIONAL BEACON)



A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of a properly equipped aircraft can determine his bearing and "home" in on the station. These facilities normally operate within the 190 to 535 kHz band and transmit a continuous carrier with either a 400 Hz or 1020 Hz modulation keyed to provide identification (except during voice transmission). Radio beacons are subject to disturbances that may result in erroneous bearing information. The signal is not subject to line-of-sight restrictions, but rather to power output of the ground station.

MARKER BEACON

Marker beacons transmit low power 75 MHz signals vertically to indicate to pilots when they are passing over the beacon. These beacons are typically used with other navaids to identify a particular location along a route. When marker beacons are used with an ILS approach, they are called Outer Markers (OMs), Middle Markers (MMs), and Inner Markers (IMs) and are modulated as follows:

- OM – 400 Hz, identified with continuous dashes and a blue marker beacon annunciator
- MM – 1,300 Hz, identified with continuous alternate dots and dashes and an amber marker beacon annunciator
- IM – 3,000 Hz, identified with continuous dots and a white marker beacon annunciator

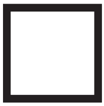
ILS (INSTRUMENT LANDING SYSTEM)

An ILS is a precision approach system that a pilot in an ILS equipped aircraft uses to guide the aircraft along a precise glide path (or glide slope) to the runway. An ILS consists of two ground based directional transmitters and up to three marker beacons: an OM, an MM, and in some cases, an IM.

One transmitter called the localizer transmits a signal from the center of the width of the runway to keep your aircraft lined up horizontally with the center line of the runway. The other transmitter called the glide slope transmitter transmits a glide path signal at an approximate 3-degree angle vertical to the runway out to about 10 nmi away from the runway.

The outer marker marks the point at which an aircraft at the proper altitude on the localizer horizontal course intercepts the glide slope. The middle marker marks the point at which the aircraft is approximately 3,500 feet from the landing threshold. An inner marker (when used) indicates the point at which the decision height should occur in a category II ILS.

DME (DISTANCE MEASURING EQUIPMENT)



The first DME was made available to the airlines in the late 1950's. An aircraft equipped with DME sends out paired pulses at a specific spacing. These interrogation signals, operating on the line-of-sight principle, are received by the ground station. The ground station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of the signal exchange is measured in the airborne DME unit and is translated into highly accurate distance (in nautical miles) on a slant from the aircraft to the ground station. This is commonly referred to as "slant-range distance." Slant-range distance approximates actual ground distance but may not accurately depict your horizontal distance from the station. The difference between slant-range distance and horizontal ground distance is smallest at low altitude and long range. (See figure 1-5.) These distances may differ considerably when you're at higher altitudes and close to the ground station.

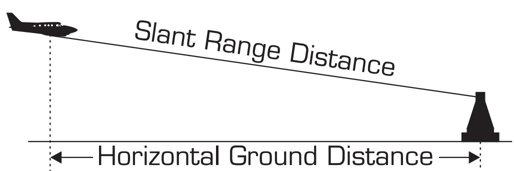
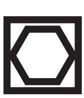


Figure 1-5. Slant Range Distance

DME operates on frequencies in the UHF band between 962 and 1213 MHz. Aircraft equipped with a VOR receiver must also have a separate DME unit if it is required to receive distance information. An aircraft equipped with TACAN equipment does not need a separate DME unit: it automatically receives distance information from the tuned DME ground station.

VOR/DME



VOR/DME is the co-location of VOR and DME equipment at the same ground station. They are used in conjunction with each other to provide the pilot with both DME distance and VOR bearing information if the aircraft is equipped with both VOR and DME units.

ILS/DME

ILS/DME is an ILS approach that uses a DME ground station or a distance to a DME ground station in place of an outer marker beacon.

TACAN (Tactical Air Navigation)

In the early 1950's, with the VOR system in place and operating, a new navigation system, TACAN, was developed by the military to meet military tactical requirements. For reasons specific to the military (unusual or strategic locations, pitching and rolling naval vessels, etc.) the separate civilian VOR and DME systems of air navigation were considered unsuitable for military use.

TACAN had the distinct advantage over separate VOR and DME systems of providing the military with distance as well as radial information from a single airborne transmitter/receiver operating on frequencies in the UHF spectrum between 962 and 1,213 MHz just like DME. (The distance portion of TACAN operates the same as all other DME). Another advantage of this arrangement is that there is no possibility through manual error or malfunctioning of an automatic mechanism to receive bearing from one source and distance from another, because the two services are provided by one radio set operating on one channel. Additionally, the information from the TACAN station is extremely accurate and reliable.

Early airborne TACAN equipment was too large, weighed too much (about 71 pounds), and consumed too much power to be practical for civilian use. In the early 1960's, smaller, lighter, and lower-cost airborne DME and TACAN systems became available, but TACAN is still mainly used by the military.

The original airborne TACAN systems determined the relative bearing and slant range distance to a selected TACAN or VORTAC station. Later systems also displayed ground speed and time-to-station. Since TACAN signals are in the UHF frequency band, the system operating range is limited to line of sight just like VOR signals, unlike Automatic Direction Finder (ADF) systems which can overcome obstacles such as mountains and buildings. The maximum range obtainable varies proportionally with the altitude of the aircraft (table 1-3) and also depends on the type of terrain.

Table 1-3. TACAN Effective Range

Altitude ft AGL	LOS Range nmi	Altitude ft AGL	LOS Range nmi	Altitude ft AGL	LOS Range nmi
1,000	39	9,000	117	45,000	261
2,000	55	10,000	123	50,000	275
3,000	67	15,000	151	55,000	289
4,000	78	20,000	174	60,000	301
5,000	87	25,000	195	70,000	325
6,000	95	30,000	213	80,000	348
7,000	103	35,000	230	90,000	369
8,000	110	40,000	246	100,000	389

This table represents flight over level terrain with the ground station at sea level.

This table provides optimum distances which are not always attainable due to terrain and TACAN equipment installation variables.

TACAN systems operate on one of 252 channels, consisting of 126 X-mode channels and 126 Y-mode channels, in accordance with MIL-STD-291C and NATO STANAG 5034. Fifty-two channels are reserved for military use only: channels 1-16 (X- and Y-mode) are mainly for ships at sea, and channels 60-69 (X- and Y-mode) are for special military operations. The channel number selected by the airborne TACAN operator determines which frequency in the 1,025–1,150 MHz range is used to interrogate the ground station. The TACAN ground station transmits reply information in a frequency range of 962–1,213 MHz. The separation between the interrogation signal from an airborne TACAN system and the ground station reply is 63 MHz. See table A-2 for details.

The airborne TACAN unit can receive the TACAN ground station's ident and bearing signals and calculate the bearing without interrogating the ground station; however, the TACAN unit must interrogate the ground station to compute range.

VORTAC

When the first DME was made available to the airlines in the late 1950's, civilian and military authorities agreed upon a coordinated arrangement for VOR, DME, and TACAN systems to enable civilian and military aircraft to navigate on the same airways. VOR and TACAN ground stations were co-located to form VORTAC navigation facilities (figure 1-6). The VHF-band VOR frequencies were paired with UHF-band TACAN channels so that each VOR frequency would have a corresponding TACAN channel number (table A-1). All TACAN and VOR pairings worldwide are ICAO controlled. With this arrange-

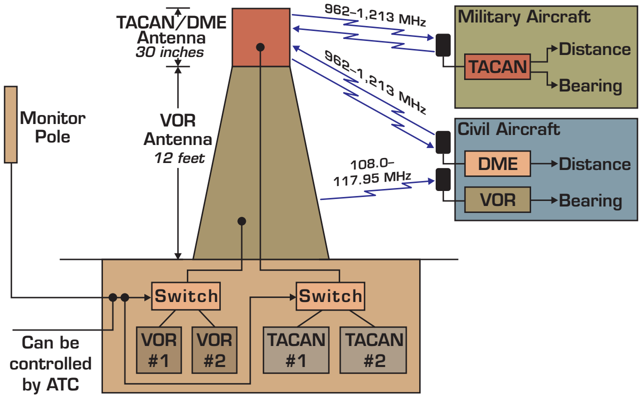


Figure 1-6. Typical VORTAC Site

ment, the VOR component continues to provide VOR-equipped civilian aircraft with bearing information in the VHF range while the TACAN component provides distance and bearing in the UHF range to TACAN equipped-aircraft. Existing airborne DME transceivers can also use the distance portion of the TACAN signal to compute range. The TACAN bearing information continues to be used primarily by the military.

Airborne VOR receivers take advantage of the VOR frequency/TACAN channel pairing by tuning a separate DME unit to the TACAN channel (DME frequency) that corresponds to the VOR frequency dialed by the pilot on the VHF/NAV frequency selector for the desired VORTAC ground station. Any DME that is tuned to a VORTAC or TACAN ground station will receive distance information, but aircraft must have a TACAN receiver (or the DME must have TACAN bearing decoding capability) to make use of the ground station's TACAN bearing signals. Navigation charts show both the VOR frequency and the corresponding TACAN channel for each VORTAC ground station.

ADVANTAGES OF TACAN

VOR is susceptible to the reflected signal distortion that can cause "scalloping." VOR scalloping occurs mostly in areas that are mountainous, or where the VOR signal is reflected from terrain. Scalloping normally causes the VOR needle to swing slowly to the left and right of the course. To keep the needle centered, the pilot makes a series of gentle "S" turns along the course. Operating in the UHF "L" band radar frequency range (1 GHz), TACAN uses a modulation and pulse decoding scheme that makes the bearing signal less vulnerable to scalloping. The wavelength at the VOR frequency is 10 ft. The wavelength at the TACAN frequency is 1.0 ft.

Modulations caused by the rotation of propellers or helicopter rotors can interfere with the VOR signal and cause erratic navigation indications. When this problem occurs, the condition is sometimes improved by increasing or decreasing propeller or rotor rotation by 100 or 200 rpm. The TACAN modulation and pulse decoding scheme along with the higher frequency and shorter wavelength of the transmitted signal significantly reduces this problem.

An airborne TACAN system provides both bearing and distance information using only one antenna. The redundancy that TACAN offers is also an important advantage. TACAN bearing information is approved by the FAA (AC-0031A) as a substitute for VOR bearing information in airway navigation and non-precision approaches when using a VORTAC or TACAN facility. FAA advisory circular 90-45A, as amended by change 2 also permits RNAV operations using TACAN instead of VOR. TACAN can be used to compute second waypoint or third flight path information. Because VOR and TACAN use separate, independent equipment in the aircraft and at the ground facility, neither airborne nor ground station VOR failures will disable TACAN. Therefore, if a VOR equipment failure occurs, a TACAN-equipped aircraft may continue to receive navigation information using TACAN.

Because TACAN is the primary military air navigation aid, TACAN-only ground stations are located at military installations throughout the world. These military TACAN stations can also serve as a convenient navigation aid for the TACAN-equipped civilian operator.

Having TACAN onboard can also be very useful in situations in which an available TACAN approach to a runway is the only usable approach considering current wind and weather conditions. Maybe this explains why even the space shuttle has TACAN transceivers on board.

The FAA flight checks VOR, VORTAC, and TACAN-only ground stations for accuracy. VOR is flight-checked to a bearing accuracy of ±2.5 degrees. TACAN is flight-checked to a bearing accuracy of ±2.0 degrees.

CHAPTER 2
SYSTEM DESCRIPTION

GENERAL DESCRIPTION

The AN/ARN-154(V) Tactical Air Navigation system (TACAN) provides the flight crew and onboard avionics systems with the distance, bearing, ground speed, and time to TACAN ground stations; the distance, ground speed, and time to DME ground stations; and the distance, speed, and time to other TACAN-equipped aircraft. The AN/ARN-154(V) also aurally announces in morse code the identifier for the selected TACAN or DME ground station over the cockpit audio system.

The AN/ARN-154(V) (figure 2-1) is designed to operate in rugged military environments. It consists of the RT-1634(V) TACAN transceiver, an optional L-3 TACAN control unit (such as the F6555), an optional L-3 TACAN indicator [such as the ID-2502(V)], and one or two customer-supplied L-band antennas

Figure 2-1. TACAN Model AN/ARN-154(V)

(not shown). You can use your own compatible tuning and display devices such as an HSI, EFIS, MFD, or FMS in place of, or in addition to the L-3 control and display units.

RT-1634(V) TACAN Transceiver

The RT-1634(V) TACAN transceiver is a lightweight (6.5 lb) unit that is tray-mounted typically in the avionics bay. The transceiver contains circuits that transmit and receive Radio Frequency (RF) signals.

It transmits:

- Distance interrogations to TACAN and DME ground stations in air-to-ground (A/G) mode
- Distance replies to other aircraft in air-to-air (A/A) mode

It receives:

- TACAN bearing signals from TACAN ground stations in A/G mode
- Distance replies from TACAN and DME ground stations in A/G mode
- Station identification signals from TACAN and DME ground stations in A/G mode
- Distance interrogations from other aircraft in A/A mode

Other circuits in the unit decode the received signals and calculate distance to station or aircraft, speed to station or aircraft, bearing to station, time to station or aircraft, course deviation, and station identification. The RT-1634(V) then uses the processed information to drive various analog or digital navigation instrument displays.

TACAN Control Unit or Tuning Source

The AN/ARN-154(V) requires a control unit or remote tuning source for the pilot to use to tell the RT-1634(V) what TACAN channel to tune. The L-3 F6555 and F3849 TACAN control units (figures 2-2 and 2-3) are two of the many TACAN control units that L-3 offers to meet this requirement, including some Night Vision Goggle (NVG) compatible versions. The F6555 and F3849 include controls for station identification volume, operating

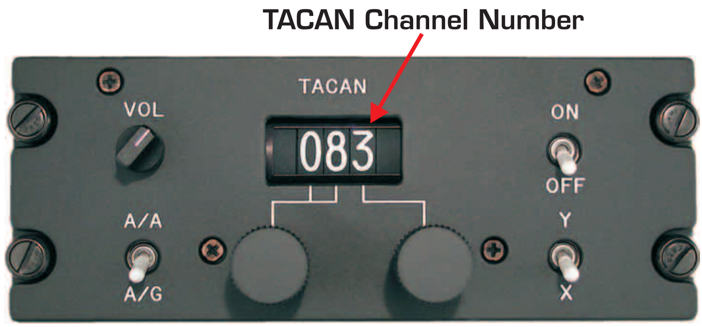


Figure 2-2. L-3 TACAN Control Unit Model F6555

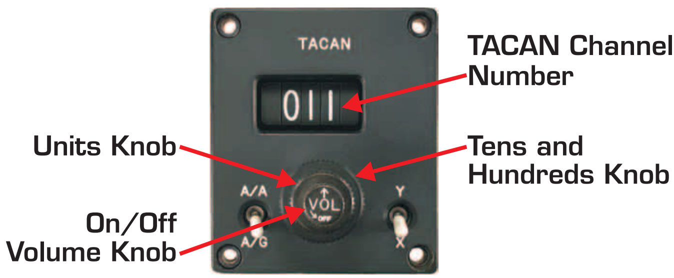


Figure 2-3. L-3 TACAN Control Unit Model F3849

mode selection (A/A or A/G), TACAN channel selection, power on/off control, and channel mode selection (X or Y).

The RT-1634(V) is compatible directly [or through the ID-2502(V) indicator] with many other control units and remote tuning sources. These control units and tuning sources include:

- Bendix King RMS 555/KDA 557 radio management system
- Universal Avionics UNS-1B or UNS-1D FMS
- Global Wulfsberg GNS-X NAV long range navigation system
- Honeywell KNR634A VOR receiver
- Mission Display Processor (MDP)

and others using interface formats such as RS-485, ARINC 429, 575, and 410 (2 X 5 code), TACAN Binary Coded Decimal (BCD), slip code, shifted BCD, and Collins Serial Data Bus (CSDB).

Contact L-3 Avionics Systems to find out if your control unit or remote tuning source will work directly with one of the many variations of the RT-1634(V) or through the ID-2502(V) indicator.

TACAN INDICATOR OR DISPLAY

The AN/ARN-154(V) requires a TACAN indicator or navigation instrument display to display the navigation information gathered and processed by the RT-1634(V). L-3 offers many versions of its ID-2502(V) TACAN indicator (figure 2-4) to meet this requirement including some NVG-compatible versions.

The ID-2502(V) uses high intensity, dot-matrix Light Emitting Diodes (LEDs) for the display segments and a photocell to regulate the display's brightness.

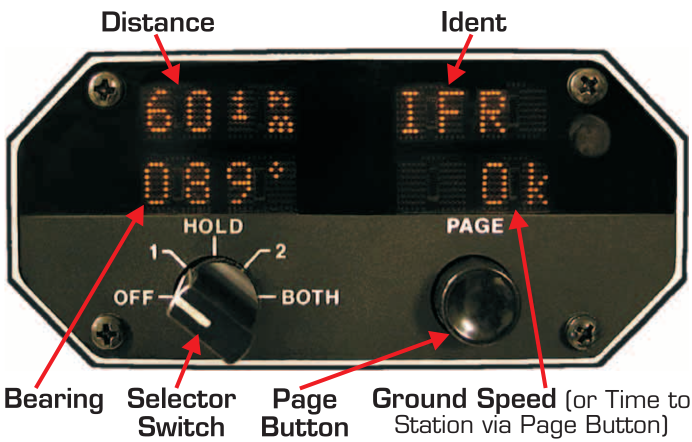


Figure 2-4. L-3 TACAN Indicator Model ID-2502(V)

In A/G mode, the ID-2502(V) displays:

- Slant range **distance** to the TACAN or DME ground station (up to 400 nmi away) in the upper left display quadrant
- Alphanumeric TACAN or DME ground station identifier (**ident**) in the upper right display quadrant. After the RT-1634(V) locks onto the ground station signal, it may take up to 2 minutes to decode the ident signal before the ident is displayed on the indicator.
- **Ground speed** to station (up to 999 knots) or the **time to station** (up to 99 minutes) in the lower right display quadrant using the page button to switch between the two
- **Bearing** to, or radial from the TACAN ground station in the lower left display quadrant depending on the version of the indicator installed

- Selected TACAN channel or the paired VOR frequency in a lower display quadrant when the selector switch is positioned half way between any two adjacent selector switch positions. Pressing the page button switches between displaying the TACAN channel and the paired VOR frequency.
- Information for two stations (on some versions)

In A/A mode, the ID-2502(V) displays:

- Slant range **distance** to the closest A/A-capable TACAN-equipped aircraft in range that's in A/A mode and set to a TACAN channel 63 channels above or below your own aircraft's TACAN channel setting. This distance is displayed in the upper left quadrant.
- **A/A flag** in the upper right display quadrant to remind you that the AN/ARN-154(V) is in A/A mode
- **Closure rate** (up to 999 knots) or the **time to rendezvous** (up to 99 minutes) in the lower right display quadrant using the page button to switch between the two
- **DME flag** in the lower left display quadrant indicating that only distance is available in A/A mode

The ID-2502(V) can also serve as a tuning interface converter, accepting various tuning formats and translating them to RS-485 for input into the RT-1634(V).

Refer to the *DME/TACAN Indicator Pilot's Guide* for more details on the different versions and features of the indicator.

The RT-1634(V) is compatible with many other navigation instrument displays such as HSIs (figure 2-5), Course Deviation Indicators (CDIs) (figure 2-6), Radio Magnetic Indicators (RMIs) (figure 2-7), Multi-Function Displays (MFDs), FMSs, Bearing & Distance Horizontal Indicators (BDHIs) (figure 2-8), and EFISs (figures 2-9 and 2-10). These displays include:

- Bendix King RMS 555/KDA 557 radio management system
- Universal Avionics UNS-1B or UNS-1D FMS
- Mission Display Processor (MDP)
- Bendix King Flat Panel Display FPD-500
- Honeywell EFIS

and others using interface formats such as RS-485, ARINC 429, 547, 568, and 579. Contact L-3 to ask about your display.

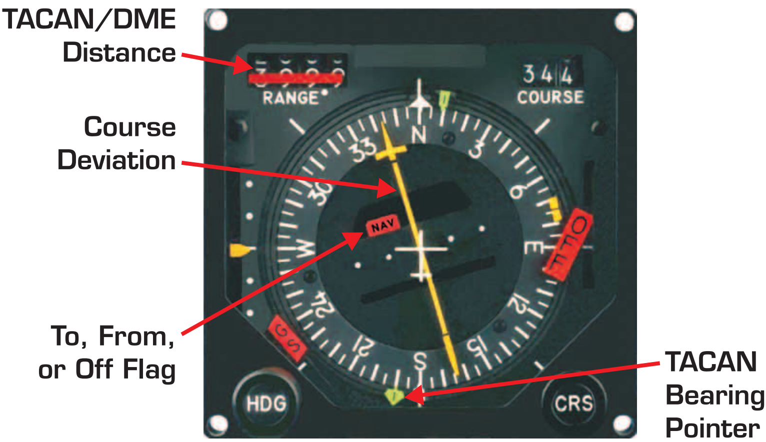


Figure 2-5. TACAN Information on an HSI

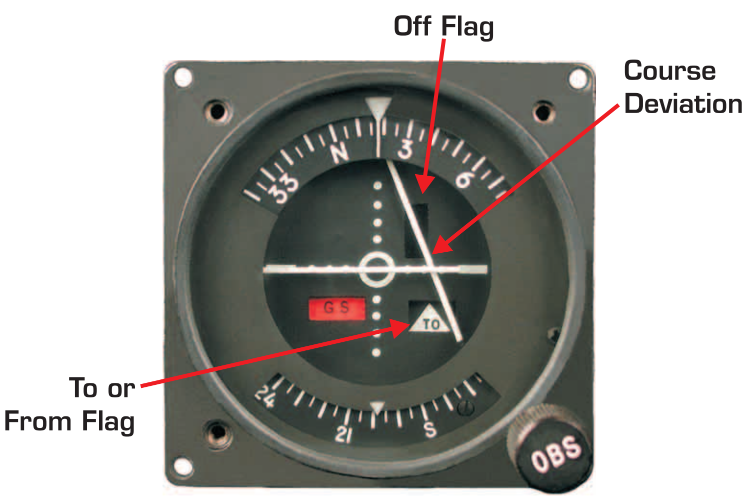


Figure 2-6. TACAN Information on a CDI

Figure 2-7. TACAN Information on an RMI

Figure 2-8. TACAN Information on a BDHI

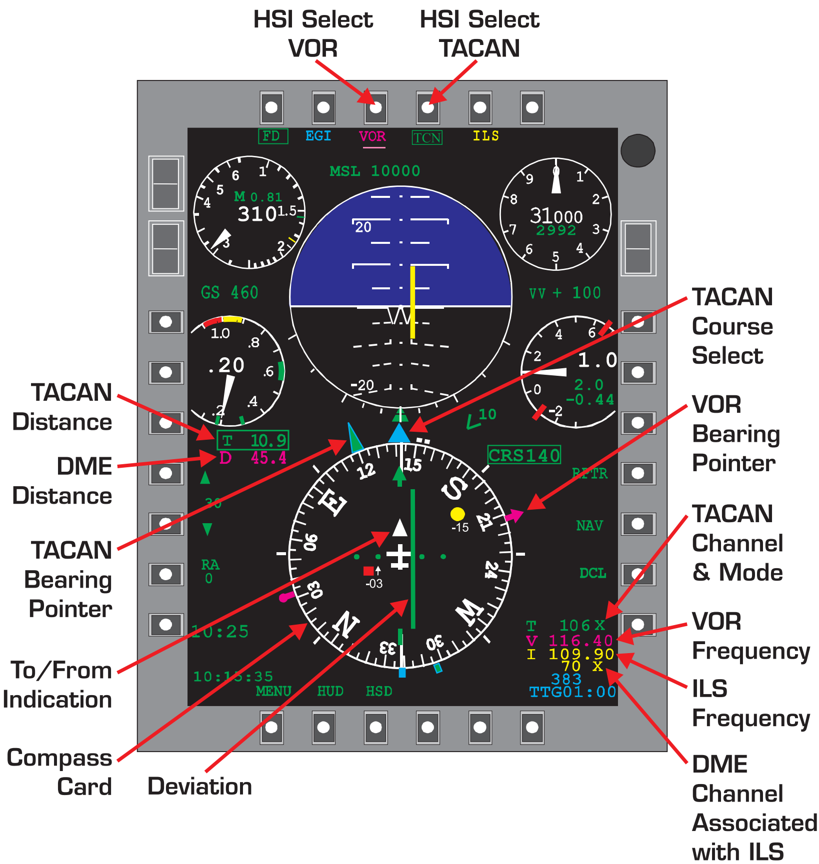


Figure 2-9. TACAN Information on a Boeing EFIS

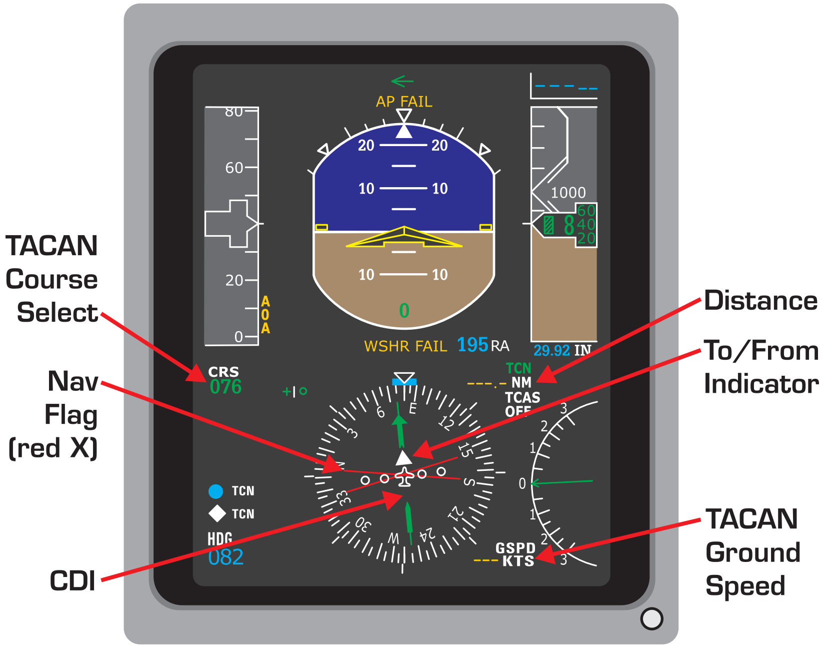
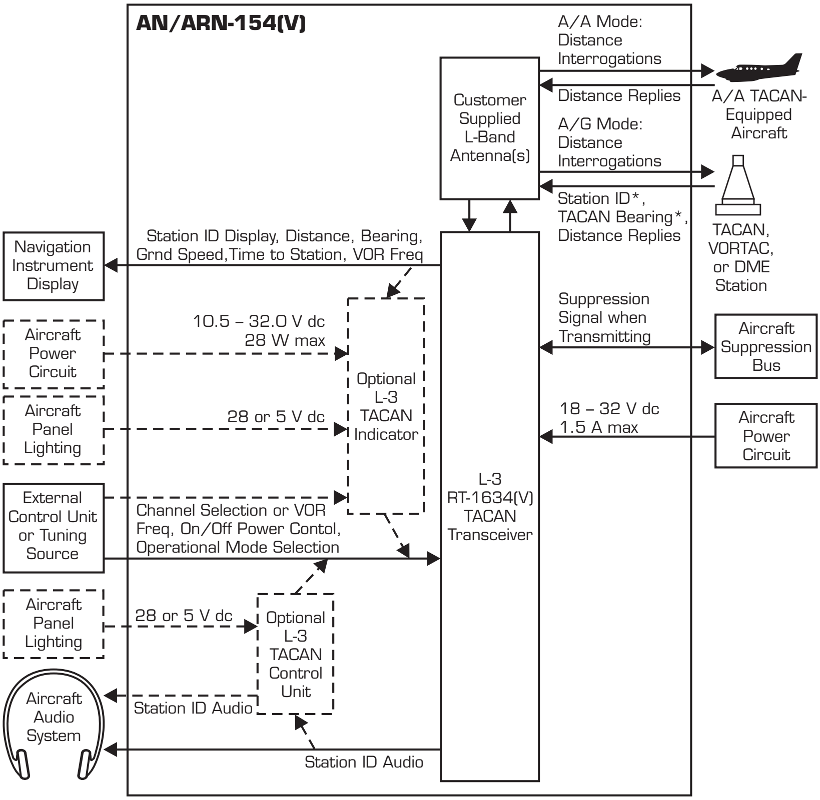


Figure 2-10. TACAN Information on a UC-35 EFIS

INTERACTION OF MAJOR COMPONENTS

Figure 2-11 shows in general how the major components of the AN/ARN-154(V) connect to each other and to other aircraft systems.



*TACAN and VORTAC stations periodically transmit station ID and TACAN bearing without being interrogated.

Figure 2-11. AN/ARN-154(V) Simplified Functional Block Diagram

Features

- World's lightest and smallest TACAN transceiver
- Multi-station tracking
- Operates as a TACAN and a DME simultaneously
- Air-to-ground and air-to-air modes
- Designed for rugged military environments
- Analog and digital interfaces available including ARINC 429
- Optional control units and indicators available
- NVG-compatible control units and indicators available
- Tray-mounted transceiver
- Uses your existing aircraft L-band antenna(s)

CHAPTER 3
NAVIGATING WITH TACAN

INTRODUCTION

The first part of this chapter describes one example of how to navigate with the TACAN AN/ARN-154(V). The example uses an RMI as the navigation instrument displaying TACAN bearing. The same general principles apply when using different navigation instrument displays.

The second part of this chapter describes the A/A mode of operating the AN/ARN-154(V).

RMI CONTROLS & INDICATORS

The following paragraphs describe the controls and indicators of the RMI shown in figure 3-1.

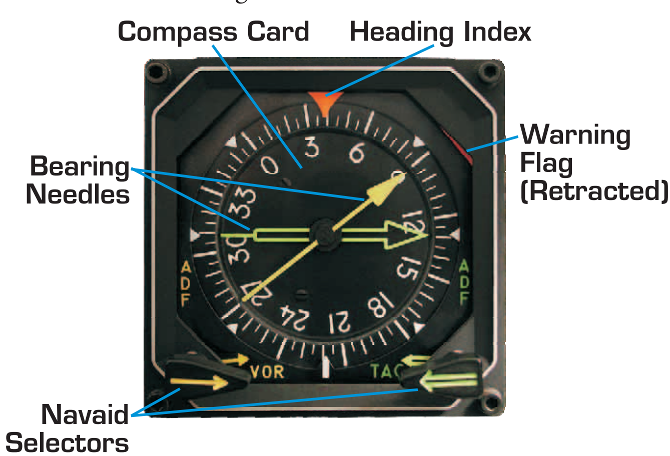


Figure 3-1. Typical RMI Controls & Indicators

NAVAID SELECTORS

Each of these two rotary switches selects the navaid to be used for bearing indication by its corresponding RMI bearing needle (yellow single-bar and green double-bar).

BEARING NEEDLES

Each needle indicates bearing information provided by the corresponding selected navaid. The head (arrow) of the needle indicates bearing to the station. The tail of the needle indicates the radial from the station.

COMPASS CARD

The compass card rotates in relation to magnetic north. It is gryo-stabilized and compensated for deviation.

HEADING INDEX

The heading index, or lubber line, is a stationary pointer that indicates aircraft heading in relation to the compass card.

WARNING FLAG

The appearance of the red flag pointer indicates instrument power off, system malfunction, servo error (gyro not aligned with flux gate compass), or invalid compass.

NO BEARING INDICATION

Until the RT-1634(V) TACAN transceiver receives and decodes the TACAN bearing, the RMI either parks the needle at the 90-degree position, or rotates the needle counterclockwise at a constant speed.

RMI PRIMARY USES

- To determine aircraft heading for all flight purposes. The stationary RMI heading index (lubber line) points to the magnetic heading of the aircraft on the rotating compass card.
- To assist in rapid visual or graphic positioning. The magnetic bearing (radial) from an NDB, VOR, or TACAN station is indicated by the tail of the corresponding bearing needle. With VOR or TACAN, this radial can be plotted on a navigation chart by drawing a line from the station through the point on the station's compass rose that corresponds to the indicated bearing.

- To determine the direction (left or right) and degrees of turn necessary to intercept a desired course.
- To home or track directly to or from a station. By turning the aircraft to the same heading indicated by the bearing needle (head of needle if inbound to the station or tail of needle if outbound from the station) and making any necessary wind drift corrections, a definite course to or from the station can be flown.
- To assist in flying any chosen course by observing the magnetic bearing to or from a station, as indicated by the corresponding bearing needle.

RMI NAVIGATION EXAMPLE

At point A in figure 3-2, the pilot departs and takes up a magnetic heading of 60 degrees, which is shown by the heading index of the RMI. The rotating compass card indicates the magnetic heading of the aircraft at all times.

Next, the yellow, single-bar needle is selected to indicate bearing to an NDB station by turning the yellow, single-bar navaid selector to ADF. Then, the green, double-bar needle is selected to indicate bearing to a TACAN station by turning the green, double-bar selector to TAC.

Each ground station transmits its own three or four letter morse code audio identifier (ident) so that when the flight crew tunes the RT-1634(V) TACAN transceiver to a TACAN or DME station, they should hear the ident of the station they tuned. It is an IFR flight requirement that the aircrew hears the ident and checks it against the intended station's ident listed on the navigation chart to make sure they have indeed tuned the intended station.

After properly tuning and identifying the chosen NDB and TACAN stations, the position of the aircraft is easily determined without mental computation. The RMI pictorially presents a magnetic bearing of 32 degrees to the NDB station and a magnetic bearing of 103 degrees to the TACAN station. The aircraft is now crossing the 283-degree radial of the TACAN station. This radial is the reciprocal of the bearing to the station, and is clearly shown by the tail of the green, double-bar needle. As the flight continues, RMI indications appear as shown at points B and C.

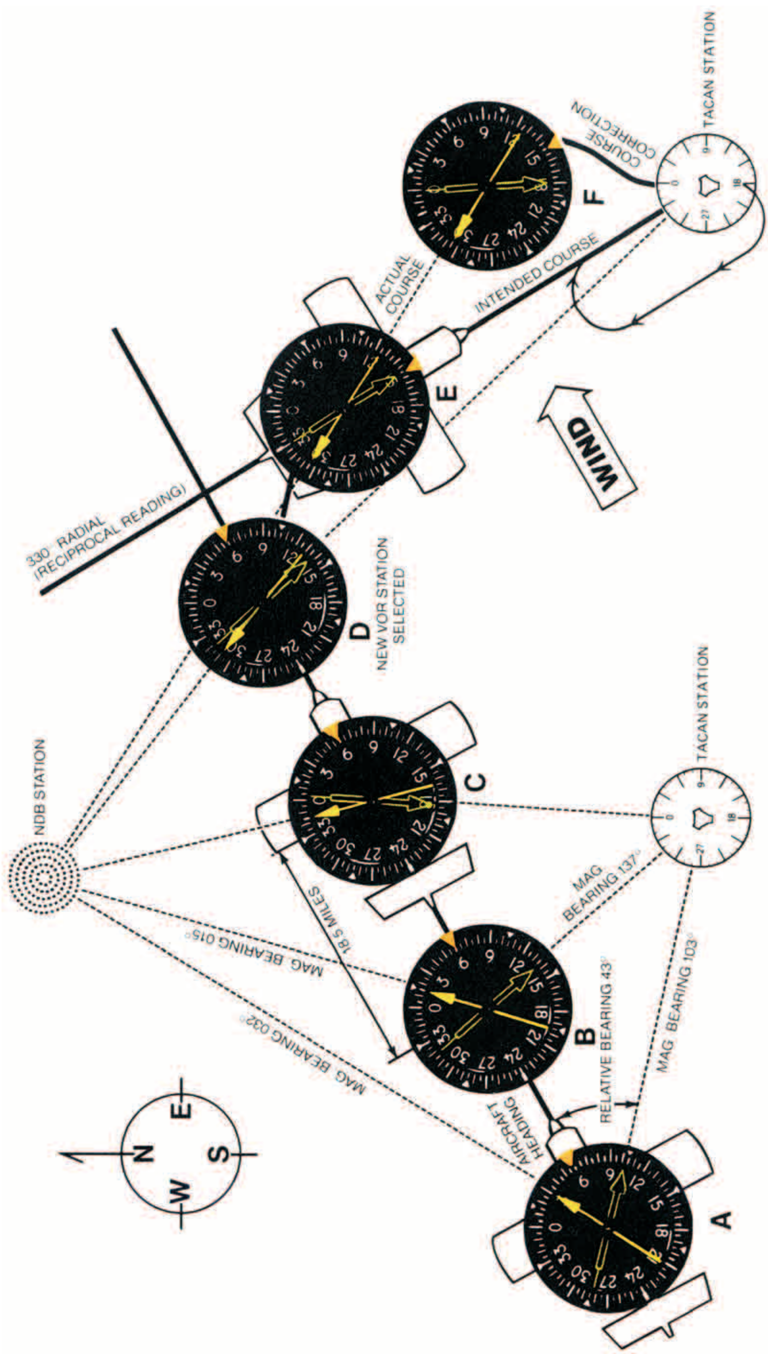


Figure 3-2. RMI Navigation Example

Nearing the approach phase of the flight at point D, the pilot tunes to a new TACAN station that is close to the final destination. The pilot wants to fly inbound to the station on a heading of 150 degrees or, in other words, fly the 330-degree radial inbound. The magnetic heading of 60 degrees is maintained until the green, double-bar needle points to within a few degrees of the desired heading. Then, at point D, the turn to intercept the heading is begun.

At point E, proceeding toward the TACAN station, any drift is readily noticed by observing needle movement, and can be corrected easily, as at point F.

A/A MODE OPERATION

When the AN/ARN-154(V) is in A/A mode, two aircraft within 400 nmi of each other can each calculate and display the distance to the other aircraft, the time to rendezvous, and the closure rate between the two aircraft. For A/A mode to work, each aircraft has to have an A/A-mode-capable TACAN transceiver (i.e., compatible with MIL-STD-291C and NATO STANAG 5034). Furthermore, each aircraft must also have its TACAN control unit or tuning source set to a channel exactly 63 channels above or below the other aircraft's channel setting; for example, if aircraft A is set to channel 20X, then aircraft B must be set to channel 83X. (See table A-2.)

If there are more than two aircraft in the area in A/A mode and set to the right channels, the AN/ARN-154(V) only calculates and displays the distance, time to rendezvous, and closure rate for the closest aircraft (figure 3-3).

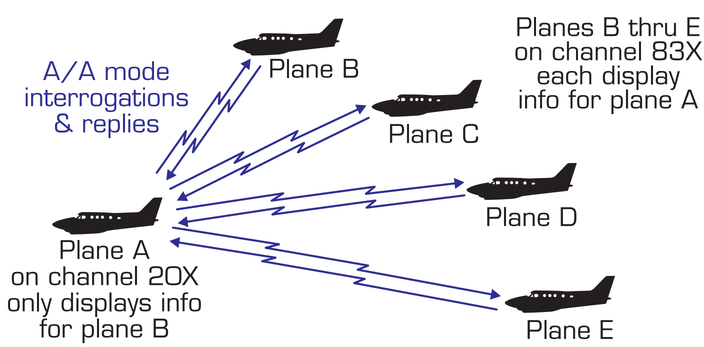


Figure 3-3. A/A Mode With Five Aircraft

CHAPTER 4

SPECIFICATIONS

*Table 4-1. RT-1634(V) TACAN Transceiver Specifications**

Part Number:
805D0602-XX (XX varies with features)

Size:
P/N 805D0602-39/-43/-44/-45:
5.02 in (12.75 cm) high
3.50 in (8.90 cm) wide
11.46 in (29.11 cm) deep
P/N 805D0602-all others:
4.96 in (12.60 cm) high
3.50 in (8.90 cm) wide
11.40 in (28.96 cm) deep

Weight:
P/N 805D0602-39/-43/-44/-45:
6.5 lb ±0.12 lb (2.95 kg ±0.03 kg)
P/N 805D0602-all others:
6.2 lb (2.81 kg)

Power Input Requirements:
18 to 32 V dc at 1.5 A maximum

Operating Altitude:
70,000 ft maximum

Operating Temperature:
-55 to +70 °C (-67 to +158 °F)

Storage Temperature:
-55 to +85 °C (-67 to +185 °F)

Cooling:
Conduction and free air convection

(Continues on next page)

*Specifications subject to change without notice.

Table 4-1. RT-1634(V) TACAN Transceiver Specifications (cont.)*

Humidity:
P/N 805D0602-39/-43/-44/-45:
RTCA DO-160C category A
P/N 805D0602-all others:
RTCA DO-160A category A, 95% at 50 °C

Vibration:
P/N 805D0602-39/-43/-44/-45:
RTCA DO-160C category NB'M
P/N 805D0602-all others:
RTCA DO-160C category NBMY

Shock:
MIL-STD-5400T, 15G, 11 ms
MIL-STD-810D, 20G, 6-9 ms, SRS

Crash Safety:
MIL-STD-5400T, 30G (with mounting tray P/N 802C0604)
MIL-STD-810D, 40G (with mounting tray P/N 802C0604), 6-9 ms, SRS

Fungus:
RTCA DO-160C category F

Waterproofness:
RTCA DO-160C category W (P/N 805D0602-39/-43/-44/-45 only)

TACAN Channels:
252 consisting of 126 X-mode channels and 126 Y-mode channels (126 of those channels are available for air-to-air ranging per MIL-STD-291C)

Tuning:
RS-485, ARINC 429, 575, and 410 2x5
Thru the ID-2502(V): slip code, TACAN BCD, shifted BCD, & CSDB

Power Output:
250 W peak minimum, 325 to 375 W peak typical

Receiver Sensitivity:
-85 dBm minimum for range, -79 dBm minimum for bearing at +25 °C

Range:
0.0 – 400 nmi

Accuracy:
±0.1 nmi

(Continues on next page)

*Specifications subject to change without notice.

Table 4-1. RT-1634(V) TACAN Transceiver Specifications (cont.)*

Range Output (ARINC-568):
0.0 – 399.9 ± 0.1 nmi (digital)
0.0 – 199.9 ± 0.1 nmi (analog)

Range Tracking Rate:
0 – 1,100 kn inbound or outbound with multi-station tracking
0 – 1,800 kn inbound or outbound with single-station tracking

Radial Track Rate:
10 degrees per second

Bearing Accuracy:
± 0.5 degrees (digital)
± 1.0 degree (analog)

Memory Time:
10–15 seconds, range and bearing

Acquisition Time:
3 seconds nominal range, 5 seconds nominal bearing

ID Tone:
P/N 805D0602-35:
5 mW into 500 Ohm load
P/N 805D0602-39/-43/-44/-45:
10 mW into 600 Ohm load
P/N 805D0602-all others:
2 mW into 500 Ohm load
Max adjustable output for all models: 12 mW into 600 Ohm load

Regulatory Compliance:
P/N 805D0602-39:
FAA PMA PQ2024CE-D on Boeing 737-700C series
P/N 805D0602-all others:
Designed to FAA TSO C66b specs & AC-0031A, FCC type accepted
Designed to MIL-STD-291C and NATO STANAG 5034

*Specifications subject to change without notice.

*Table 4-2. Optional TACAN Control Unit Specifications**

Part Number:
805D066X-XX (X-XX varies with features)

Model Number:
FXXXX (XXXX varies with features)

Size:
Model F3849 & F3849A:
2.87 in (7.29 cm) high
2.43 in (6.17 cm) wide
7.52 in (19.10 cm) deep
Model F6444:
2.61 in (6.63 cm) high
5.74 in (14.58 cm) wide
7.05 in (17.91 cm) deep
Model F6555:
2.24 in (5.69 cm) high
5.74 in (14.58 cm) wide
6.59 in (16.74 cm) deep

Weight:
Model F3849 & F3849A:
1.25 lb (0.568 kg)
Models F6444 and F6555:
2.00 lb (0.909 kg)

Panel Lighting Power Input Requirements:
5 or 28 V dc at 0.15 A maximum

Operating Altitude:
50,000 ft maximum

Operating Temperature:
-20 to +70 °C (-4 to +158 °F)

Storage Temperature:
-55 to +85 °C (-67 to +185 °F)

Vibration:
RTCA DO-160A category KPS N

Shock:
RTCA DO-160A, 6G, 11 ms

Fungus:
RTCA DO-160C category F

TACAN Channel Numbers:
3 mechanical digits

Channel Selection Output Format:
ARINC-410 2X5 coding

*Specifications subject to change without notice.

*Table 4-3. Optional ID-2502(V) TACAN Indicator Specifications**

Part Number:
805C0620-XX (XX varies with features)

Size:
1.542 in (3.92 cm) high
3.260 in (8.28 cm) wide
6.90 in (17.53 cm) deep

Weight:
1.06 lb (0.482 kg)

Power Input Requirements:
18 to 32 V dc at 28 W maximum

Operating Altitude:
55,000 ft maximum

Operating Temperature:
-20 to +70 °C (-4 to +158 °F)

Storage Temperature:
-55 to +85 °C (-67 to +185 °F)

Cooling:
Conduction and free air convection

Vibration:
RTCA DO-160A category KPS

Shock:
RTCA DO-160A, 6G, 11 ms

Range Display:
0 – 99.9 nmi and 100 – 399 nmi

Ground Speed Display:
0 – 999 knots

Time to Station Display:
0 – 99 min

Station Identification Display:
Up to four characters

Regulatory Compliance:
FAA TSO C66b compliant
RTCA DO-160A category F1A/KPS/XXXXXXZBABA

*Specifications subject to change without notice.

APPENDIX A
TACAN TABLES

TACAN, VOR, & ILS PAIRING

Table A-1 lists which VOR, ILS localizer, and ILS glideslope frequencies are paired with which TACAN channels. These pairings allow VOR and ILS control units with automatic DME selection to select the correct TACAN/DME channel.

TACAN FREQUENCIES

Table A-2 lists what frequencies are transmitted and received by the AN/ARN-154(V) in your aircraft for each TACAN channel number selected. The table also lists what TACAN frequencies and channel numbers are used by responding aircraft when the two aircraft are in A/A mode.

Table A-1. TACAN, VOR, & ILS Pairing

TACAN Channel	VOR or Localizer Freq MHz	Glideslope Freq MHz	TACAN Channel	VOR or Localizer Freq MHz	Glideslope Freq MHz	TACAN Channel	VOR Freq MHz	TACAN Channel	VOR Freq MHz
1X-16Y			42X	110.50	329.60	76X	112.90	101Y	115.45
17X	108.00		42Y	110.55	329.45	76Y	112.95	102X	115.50
17Y	108.05		43X	110.60		77X	113.00	102Y	115.55
18X	108.10	334.70	43Y	110.65		77Y	113.05	103X	115.60
18Y	108.15	334.55	44X	110.70	330.20	78X	113.10	103Y	115.65
19X	108.20		44Y	110.75	330.05	78Y	113.15	104X	115.70
19Y	108.25		45X	110.80		79X	113.20	104Y	115.75
20X	108.30	334.10	45Y	110.85		79Y	113.25	105X	115.80
20Y	108.35	333.95	46X	110.90	330.80	80X	113.30	105Y	115.85
21X	108.40		46Y	110.95	330.65	80Y	113.35	106X	115.90
21Y	108.45		47X	111.00		81X	113.40	106Y	115.95
22X	108.50	329.90	47Y	111.05		81Y	113.45	107X	116.00
22Y	108.55	329.75	48X	111.10	331.70	82X	113.50	107Y	116.05
23X	108.60		48Y	111.15	331.55	82Y	113.55	108X	116.10
23Y	108.65		49X	111.20		83X	113.60	108Y	116.15
24X	108.70	330.50	49Y	111.25		83Y	113.65	109X	116.20
24Y	108.75	330.35	50X	111.30	332.30	84X	113.70	109Y	116.25
25X	108.80		50Y	111.35	332.15	84Y	113.75	110X	116.30
25Y	108.85		51X	111.40		85X	113.80	110Y	116.35
26X	108.90	329.30	51Y	111.45		85Y	113.85	111X	116.40
26Y	108.95	329.15	52X	111.50	332.90	86X	113.90	111Y	116.45
27X	109.00		52Y	111.55	332.75	86Y	113.95	112X	116.50
27Y	109.05		53X	111.60		87X	114.00	112Y	116.55
28X	109.10	331.40	53Y	111.65		87Y	114.05	113X	116.60
28Y	109.15	331.25	54X	111.70	333.50	88X	114.10	113Y	116.65
29X	109.20		54Y	111.75	333.35	88Y	114.15	114X	116.70
29Y	109.25		55X	111.80		89X	114.20	114Y	116.75
30X	109.30	332.00	55Y	111.85		89Y	114.25	115X	116.80
30Y	109.35	331.85	56X	111.90	331.10	90X	114.30	115Y	116.85
31X	109.40		56Y	111.95	330.95	90Y	114.35	116X	116.90
31Y	109.45		57X	112.00		91X	114.40	116Y	116.95
32X	109.50	332.60	57Y	112.05		91Y	114.45	117X	117.00
32Y	109.55	332.45	58X	112.10		92X	114.50	117Y	117.05
33X	109.60		58Y	112.15		92Y	114.55	118X	117.10
33Y	109.65		59X	112.20		93X	114.60	118Y	117.15
34X	109.70	333.20	59Y	112.25		93Y	114.65	119X	117.20
34Y	109.75	333.05	60X			94X	114.70	119Y	117.25
35X	109.80		Thru			94Y	114.75	120X	117.30
35Y	109.85		69Y			95X	114.80	120Y	117.35
36X	109.90	333.80	70X	112.30		95Y	114.85	121X	117.40
36Y	109.95	333.65	70Y	112.35		96X	114.90	121Y	117.45
37X	110.00		71X	112.40		96Y	114.95	122X	117.50
37Y	110.05		71Y	112.45		97X	115.00	122Y	117.55
38X	110.10	334.40	72X	112.50		97Y	115.05	123X	117.60
38Y	110.15	334.25	72Y	112.55		98X	115.10	123Y	117.65
39X	110.20		73X	112.60		98Y	115.15	124X	117.70
39Y	110.25		73Y	112.65		99X	115.20	124Y	117.75
40X	110.30	335.00	74X	112.70		99Y	115.25	125X	117.80
40Y	110.35	334.85	74Y	112.75		100X	115.30	125Y	117.85
41X	110.40		75X	112.80		100Y	115.35	126X	117.90
41Y	110.45		75Y	112.85		101X	115.40	126Y	117.95

Table A-2. TACAN Frequencies (page 1 of 2)

Aircraft 1 TACAN Channel	Aircraft 1 Interrogation Freq MHz	Ground Reply Freq MHz	Aircraft 2 A/A Reply Freq MHz	Aircraft 2 A/A Reply Channel	Aircraft 1 TACAN Channel	Aircraft 1 Interrogation Freq MHz	Ground Reply Freq MHz	Aircraft 2 A/A Reply Freq MHz	Aircraft 2 A/A Reply Channel
1X	1025	962	1088	64X	32Y	1056	1119	1119	95Y
1Y	1025	1088	1088	64Y	33X	1057	994	1120	96X
2X	1026	963	1089	65X	33Y	1057	1120	1120	96Y
2Y	1026	1089	1089	65Y	34X	1058	995	1121	97X
3X	1027	964	1090	66X	34Y	1058	1121	1121	97Y
3Y	1027	1090	1090	66Y	35X	1059	996	1122	98X
4X	1028	965	1091	67X	35Y	1059	1122	1122	98Y
4Y	1028	1091	1091	67Y	36X	1060	997	1123	99X
5X	1029	966	1092	68X	36Y	1060	1123	1123	99Y
5Y	1029	1092	1092	68Y	37X	1061	998	1124	100X
6X	1030	967	1093	69X	37Y	1061	1124	1124	100Y
6Y	1030	1093	1093	69Y	38X	1062	999	1125	101X
7X	1031	968	1094	70X	38Y	1062	1125	1125	101Y
7Y	1031	1094	1094	70Y	39X	1063	1000	1126	102X
8X	1032	969	1095	71X	39Y	1063	1126	1126	102Y
8Y	1032	1095	1095	71Y	40X	1064	1001	1127	103X
9X	1033	970	1096	72X	40Y	1064	1127	1127	103Y
9Y	1033	1096	1096	72Y	41X	1065	1002	1128	104X
10X	1034	971	1097	73X	41Y	1065	1128	1128	104Y
10Y	1034	1097	1097	73Y	42X	1066	1003	1129	105X
11X	1035	972	1098	74X	42Y	1066	1129	1129	105Y
11Y	1035	1098	1098	74Y	43X	1067	1004	1130	106X
12X	1036	973	1099	75X	43Y	1067	1130	1130	106Y
12Y	1036	1099	1099	75Y	44X	1068	1005	1131	107X
13X	1037	974	1100	76X	44Y	1068	1131	1131	107Y
13Y	1037	1100	1100	76Y	45X	1069	1006	1132	108X
14X	1038	975	1101	77X	45Y	1069	1132	1132	108Y
14Y	1038	1101	1101	77Y	46X	1070	1007	1133	109X
15X	1039	976	1102	78X	46Y	1070	1133	1133	109Y
15Y	1039	1102	1102	78Y	47X	1071	1008	1134	110X
16X	1040	977	1103	79X	47Y	1071	1134	1134	110Y
16Y	1040	1103	1103	79Y	48X	1072	1009	1135	111X
17X	1041	978	1104	80X	48Y	1072	1135	1135	111Y
17Y	1041	1104	1104	80Y	49X	1073	1010	1136	112X
18X	1042	979	1105	81X	49Y	1073	1136	1136	112Y
18Y	1042	1105	1105	81Y	50X	1074	1011	1137	113X
19X	1043	980	1106	82X	50Y	1074	1137	1137	113Y
19Y	1043	1106	1106	82Y	51X	1075	1012	1138	114X
20X	1044	981	1107	83X	51Y	1075	1138	1138	114Y
20Y	1044	1107	1107	83Y	52X	1076	1013	1139	115X
21X	1045	982	1108	84X	52Y	1076	1139	1139	115Y
21Y	1045	1108	1108	84Y	53X	1077	1014	1140	116X
22X	1046	983	1109	85X	53Y	1077	1140	1140	116Y
22Y	1046	1109	1109	85Y	54X	1078	1015	1141	117X
23X	1047	984	1110	86X	54Y	1078	1141	1141	117Y
23Y	1047	1110	1110	86Y	55X	1079	1016	1142	118X
24X	1048	985	1111	87X	55Y	1079	1142	1142	118Y
24Y	1048	1111	1111	87Y	56X	1080	1017	1143	119X
25X	1049	986	1112	88X	56Y	1080	1143	1143	119Y
25Y	1049	1112	1112	88Y	57X	1081	1018	1144	120X
26X	1050	987	1113	89X	57Y	1081	1144	1144	120Y
26Y	1050	1113	1113	89Y	58X	1082	1019	1145	121X
27X	1051	988	1114	90X	58Y	1082	1145	1145	121Y
27Y	1051	1114	1114	90Y	59X	1083	1020	1146	122X
28X	1052	989	1115	91X	59Y	1083	1146	1146	122Y
28Y	1052	1115	1115	91Y	60X	1084	1021	1147	123X
29X	1053	990	1116	92X	60Y	1084	1147	1147	123Y
29Y	1053	1116	1116	92Y	61X	1085	1022	1148	124X
30X	1054	991	1117	93X	61Y	1085	1148	1148	124Y
30Y	1054	1117	1117	93Y	62X	1086	1023	1149	125X
31X	1055	992	1118	94X	62Y	1086	1149	1149	125Y
31Y	1055	1118	1118	94Y	63X	1087	1024	1150	126X
32X	1056	993	1119	95X	63Y	1087	1150	1150	126Y

Table A-2. TACAN Frequencies (page 2 of 2)

Aircraft 1 TACAN Channel	Aircraft 1 Interrogation Freq MHz	Ground Reply Freq MHz	Aircraft 2 A/A Reply Freq MHz	Aircraft 2 A/A Reply Channel	Aircraft 1 TACAN Channel	Aircraft 1 Interrogation Freq MHz	Ground Reply Freq MHz	Aircraft 2 A/A Reply Freq MHz	Aircraft 2 A/A Reply Channel
64X	1088	1151	1025	1X	95Y	1119	1056	1056	32Y
64Y	1088	1025	1025	1Y	96X	1120	1183	1057	33X
65X	1089	1152	1026	2X	96Y	1120	1057	1057	33Y
65Y	1089	1026	1026	2Y	97X	1121	1184	1058	34X
66X	1090	1153	1027	3X	97Y	1121	1058	1058	34Y
66Y	1090	1027	1027	3Y	98X	1122	1185	1059	35X
67X	1091	1154	1028	4X	98Y	1122	1059	1059	35Y
67Y	1091	1028	1028	4Y	99X	1123	1186	1060	36X
68X	1092	1155	1029	5X	99Y	1123	1060	1060	36Y
68Y	1092	1029	1029	5Y	100X	1124	1187	1061	37X
69X	1093	1156	1030	6X	100Y	1124	1061	1061	37Y
69Y	1093	1030	1030	6Y	101X	1125	1188	1062	38X
70X	1094	1157	1031	7X	101Y	1125	1062	1062	38Y
70Y	1094	1031	1031	7Y	102X	1126	1189	1063	39X
71X	1095	1158	1032	8X	102Y	1126	1063	1063	39Y
71Y	1095	1032	1032	8Y	103X	1127	1190	1064	40X
72X	1096	1159	1033	9X	103Y	1127	1064	1064	40Y
72Y	1096	1033	1033	9Y	104X	1128	1191	1065	41X
73X	1097	1160	1034	10X	104Y	1128	1065	1065	41Y
73Y	1097	1034	1034	10Y	105X	1129	1192	1066	42X
74X	1098	1161	1035	11X	105Y	1129	1066	1066	42Y
74Y	1098	1035	1035	11Y	106X	1130	1193	1067	43X
75X	1099	1162	1036	12X	106Y	1130	1067	1067	43Y
75Y	1099	1036	1036	12Y	107X	1131	1194	1068	44X
76X	1100	1163	1037	13X	107Y	1131	1068	1068	44Y
76Y	1100	1037	1037	13Y	108X	1132	1195	1069	45X
77X	1101	1164	1038	14X	108Y	1132	1069	1069	45Y
77Y	1101	1038	1038	14Y	109X	1133	1196	1070	46X
78X	1102	1165	1039	15X	109Y	1133	1070	1070	46Y
78Y	1102	1039	1039	15Y	110X	1134	1197	1071	47X
79X	1103	1166	1040	16X	110Y	1134	1071	1071	47Y
79Y	1103	1040	1040	16Y	111X	1135	1198	1072	48X
80X	1104	1167	1041	17X	111Y	1135	1072	1072	48Y
80Y	1104	1041	1041	17Y	112X	1136	1199	1073	49X
81X	1105	1168	1042	18X	112Y	1136	1073	1073	49Y
81Y	1105	1042	1042	18Y	113X	1137	1200	1074	50X
82X	1106	1169	1043	19X	113Y	1137	1074	1074	50Y
82Y	1106	1043	1043	19Y	114X	1138	1201	1075	51X
83X	1107	1170	1044	20X	114Y	1138	1075	1075	51Y
83Y	1107	1044	1044	20Y	115X	1139	1202	1076	52X
84X	1108	1171	1045	21X	115Y	1139	1076	1076	52Y
84Y	1108	1045	1045	21Y	116X	1140	1203	1077	53X
85X	1109	1172	1046	22X	116Y	1140	1077	1077	53Y
85Y	1109	1046	1046	22Y	117X	1141	1204	1078	54X
86X	1110	1173	1047	23X	117Y	1141	1078	1078	54Y
86Y	1110	1047	1047	23Y	118X	1142	1205	1079	55X
87X	1111	1174	1048	24X	118Y	1142	1079	1079	55Y
87Y	1111	1048	1048	24Y	119X	1143	1206	1080	56X
88X	1112	1175	1049	25X	119Y	1143	1080	1080	56Y
88Y	1112	1049	1049	25Y	120X	1144	1207	1081	57X
89X	1113	1176	1050	26X	120Y	1144	1081	1081	57Y
89Y	1113	1050	1050	26Y	121X	1145	1208	1082	58X
90X	1114	1177	1051	27X	121Y	1145	1082	1082	58Y
90Y	1114	1051	1051	27Y	122X	1146	1209	1083	59X
91X	1115	1178	1052	28X	122Y	1146	1083	1083	59Y
91Y	1115	1052	1052	28Y	123X	1147	1210	1084	60X
92X	1116	1179	1053	29X	123Y	1147	1084	1084	60Y
92Y	1116	1053	1053	29Y	124X	1148	1211	1085	61X
93X	1117	1180	1054	30X	124Y	1148	1085	1085	61Y
93Y	1117	1054	1054	30Y	125X	1149	1212	1086	62X
94X	1118	1181	1055	31X	125Y	1149	1086	1086	62Y
94Y	1118	1055	1055	31Y	126X	1150	1213	1087	63X
95X	1119	1182	1056	32X	126Y	1150	1087	1087	63Y

RECORD OF IMPORTANT INFORMATION

DEALER INFORMATION

Name ____________________

Address ____________________

City, State, Zip ____________________

Telephone ____________________

EQUIPMENT INFORMATION

Date of Purchase ____________________

Installation Date ____________________

RT-1634(V) TACAN Transceiver:

- Part Number ____________________
- Serial Number ____________________
- Mod Letter ____________________
- Software Version ____________________

Optional L-3 TACAN Indicator:

- Model Number ____________________
- Part Number ____________________
- Serial Number ____________________
- Mod Letter ____________________

Optional L-3 TACAN Control Unit:

- Model Number ____________________
- Part Number ____________________
- Serial Number ____________________
- Mod Letter ____________________

communications

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TACAN AN/ARN-154(V)