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Indexul Operelor Plagiate în România
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Decizie de indexare a faptei de plagiat la poziţia
00476 / 14.02.2022
şi pentru admitere la publicare în volum tipărit

care se bazează pe:

A. Nota de constatare şi confirmare a indiciilor de plagiat prin fişa suspiciunii inclusă în decizie.

Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion

Opera suspicionată (OS) Suspicious work		Opera autentică (OA) Authentic work
OS	CÎRCIU, Ionică. *Radarul panoramic de bord*, Referent ştiinţific: Prof.univ.Stelian Pânzaru, Braşov: Editura Academiei Forţelor Aeriene "Henri Coandă", 2008.	
OA	AlliedSignal, *RDR 2000. Digital Weather Radar System. Pilot's Guide*, Ediţia 3, 1996-1998. Disponibil la: https://www.seaerospace.com/product_resources/RDR2000_ART2K_PG.pdf. Ultima accesare: 12.02.2022.	
Incidenţa minimă a suspiciunii / Minimum incidence of suspicion		
P01	p.100:07-10	p.13:02-05
P02	p.100: tab.5.1	p.14: tab. Radar Display
P03	p.101:03-10	p.14:01-09
P04	p.101: fig.5.3	p.13: fig. RADAR REFLECTIVITY
P05	p.103: fig.5.4	p.32: fig. SHADOWED AREAS
P06	p.104:01-08	p.5:25-31 ‚1)'
P07	p.104: fig.5.5	p.4: fig. TEST PATERN
P08	p.105:01-22	p.6:01-19 ‚2)... 9)'
P09	p.106:04-10	p.4:12-17
P10	p.106:11-17	p.5:03-14
P11	p.107:01-12	p.27:15-23
P12	p.107:13 – p.108:17	p.29:01-23
P13	p.109: fig.5.6	p.30 – p.31
P14	p.110:06-22	p.34:01-10; p.34:14-18
P15	p.111:01-03	p.35:02-03
P16	p.111:04-08	p.36:01-05
P17	p.111: fig.5.7	p.35: fig. Blind Alley
P18	p.111:09 – p.112:04	p.38:28 – p.39:03
P19	p.112:08-17	p.38:19-26
P20	p.113:02 – p.114:07	p.41:37-44
P21	p.113: fig.5.8	p.41: Figure 4
P22	p.113: fig.5.9	p.40: Figure 1
P23	p.114:14 – p.115:16	p.43:07-24
P24	p.115: fig.5.10	p.45: Figure 5 + Figure 5A
P25	p.116:01-08	p.45:01-08 ‚Figure 5:'
P26	p.116: fig.5.11	p.48: Figure 8 + Figure 8A
P27	p.116:09-11	p.48:01-03 ‚Figure 8:'
Fişa întocmită pentru includerea suspiciunii în Indexul Operelor Plagiate în România de la Sheet drawn up for including the suspicion in the Index of Plagiarized Works in Romania at www.plagiate.ro		

Notă: Prin „p.72:00" se înţelege paragraful care se termină la finele pag.72. Notaţia „p.00:00" semnifică până la ultima pagină a capitolului curent, în întregime de la punctul iniţial al preluării.

Note: By „p.72:00" one understands the text ending with the end of the page 72. By „p.00:00" one understands the taking over from the initial point till the last page of the current chapter, entirely.

B. **Fişa de argumentare a calificării** de plagiat alăturată, fişă care la rândul său este parte a deciziei.

Echipa Indexului Operelor Plagiate în România

Fişa de argumentare a calificării

Nr. crt.	Descrierea situaţiei care este încadrată drept plagiat	Se confirmă
1.	Preluarea identică a unor fragmente (piese de creaţie de tip text) dintr-o operă autentică publicată, fără precizarea întinderii şi menţionarea provenienţei şi însuşirea acestora într-o lucrare ulterioară celei autentice.	✓
2.	Preluarea unor fragmente (piese de creaţie de tip text) dintr-o operă autentică publicată, care sunt rezumate ale unor opere anterioare operei autentice, fără precizarea întinderii şi menţionarea provenienţei şi însuşirea acestora într-o lucrare ulterioară celei autentice.	
3.	Preluarea identică a unor figuri (piese de creaţie de tip grafic) dintr-o operă autentică publicată, fără menţionarea provenienţei şi însuşirea acestora într-o lucrare ulterioară celei autentice.	
4.	Preluarea identică a unor tabele (piese de creaţie de tip structură de informaţie) dintr-o operă autentică publicată, fără menţionarea provenienţei şi însuşirea acestora într-o lucrare ulterioară celei autentice.	
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7.	Preluarea identică de pasaje (piese de creaţie) dintr-o operă autentică publicată, fără precizarea întinderii şi menţionarea provenienţei, fără nici o intervenţie personală care să justifice exemplificarea sau critica prin aportul creator al autorului care preia şi însuşirea acestora într-o lucrare ulterioară celei autentice.	✓
8.	Preluarea identică de figuri sau reprezentări grafice (piese de creaţie de tip grafic) dintr-o operă autentică publicată, fără menţionarea provenienţei, fără nici o intervenţie care să justifice exemplificarea sau critica prin aportul creator al autorului care preia şi însuşirea acestora într-o lucrare ulterioară celei autentice.	
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11.	Preluarea identică a textului (piese de creaţie de tip text) unei lucrări publicate anterior sau simultan, cu acelaşi titlu sau cu titlu similar, de un acelaşi autor / un acelaşi grup de autori în publicaţii sau edituri diferite.	
12.	Preluarea identică de pasaje (piese de creaţie de tip text) ale unui cuvânt înainte sau ale unei prefeţe care se referă la două opere, diferite, publicate în două momente diferite de timp.	

Alte argumente particulare: a) Preluările de poze nu indică sursa, locul unde se află, autorul real sau posibil.

Notă:

a) Prin „provenienţă" se înţelege informaţia din care se pot identifica cel puţin numele autorului / autorilor, titlul operei, anul apariţiei.

b) Plagiatul este definit prin textul legii[1].

> *„ …plagiatul – expunerea într-o operă scrisă sau o comunicare orală, inclusiv în format electronic, a unor texte, idei, demonstraţii, date, ipoteze, teorii, rezultate ori metode ştiinţifice extrase din opere scrise, inclusiv în format electronic, ale altor autori, fără a menţiona acest lucru şi fără a face trimitere la operele originale…".*

Tehnic, plagiatul are la bază conceptul de **piesă de creaţie** care[2]:

> *„…este un element de comunicare prezentat în formă scrisă, ca text, imagine sau combinat, care posedă un subiect, o organizare sau o construcţie logică şi de argumentare care presupune nişte premise, un raţionament şi o concluzie. Piesa de creaţie presupune în mod necesar o formă de exprimare specifică unei persoane. Piesa de creaţie se poate asocia cu întreaga operă autentică sau cu o parte a acesteia…"*

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> *„…O operă de creaţie se găseşte în poziţia de operă plagiată sau operă suspicionată de plagiat în raport cu o altă operă considerată autentică dacă:*
> *i) Cele două opere tratează acelaşi subiect sau subiecte înrudite.*
> *ii) Opera autentică a fost făcută publică anterior operei suspicionate.*
> *iii) Cele două opere conţin piese de creaţie identificabile comune care posedă, fiecare în parte, un subiect şi o formă de prezentare bine definită.*
> *iv) Pentru piesele de creaţie comune, adică prezente în opera autentică şi în opera suspicionată, nu există o menţionare explicită a provenienţei. Menţionarea provenienţei se face printr-o citare care permite identificarea piesei de creaţie preluate din opera autentică.*
> *v) Simpla menţionare a titlului unei opere autentice într-un capitol de bibliografie sau similar acestuia fără delimitarea întinderii preluării nu este de natură să evite punerea în discuţie a suspiciunii de plagiat.*
> *vi) Piesele de creaţie preluate din opera autentică se utilizează la construcţii realizate prin juxtapunere fără ca acestea să fie tratate de autorul operei suspicionate prin poziţia sa explicită.*
> *vii) In opera suspicionată se identifică un fir sau mai multe fire logice de argumentare şi tratare care leagă aceleaşi premise cu aceleaşi concluzii ca în opera autentică…"*

[1] Legea nr. 206/2004 privind buna conduită în cercetarea ştiinţifică, dezvoltarea tehnologică şi inovare, publicată în Monitorul Oficial al României, Partea I, nr. 505 din 4 iunie 2004
[2] ISOC, D. *Ghid de acţiune împotriva plagiatului: bună-conduită, prevenire, combatere*. Cluj-Napoca: Ecou Transilvan, 2012.
[3] ISOC, D. *Prevenitor de plagiat*. Cluj-Napoca: Ecou Transilvan, 2014.

Grupul pentru Reformă şi Alternativă Universitară
Pagina web : www.graur.org Fondata in 2004 la Cluj Napoca. Nr.19643/2407/A/2004 din RN al ONG-urilor al Min. Justiţiei Romania, 400424 Cluj-Napoca // Dostoievski 26 E-mail: office@graur.org

Pilot's Guide

RDR 2000

Digital Weather Radar System

BENDIX/KING®

006-08755-0001 Revision 3

AlliedSignal

WARNING

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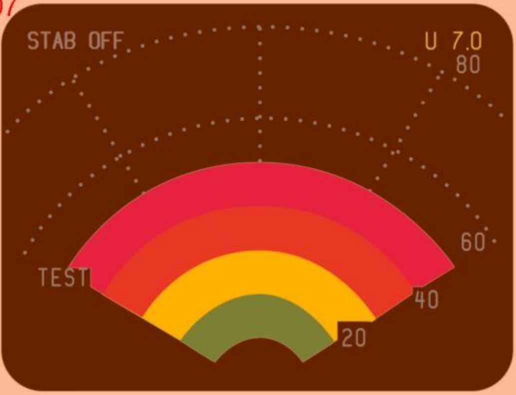
TEST PATTERN



FAULT ANNUNCIATIONS

Fault annunciations are a method of alerting the pilot that the radar system is not performing to established standards. Built-in test equipment (BITE) automatically and constantly tests the radar system. If a fault occurs, the fault annunciation will be presented on the Display unit. There are two general categories of faults: hard failures and soft failure/annunciations. By careful observation of the Display, you can quickly evaluate the condition of the ART 2000.

Hard failures are those which occur when a major function of the system is lost. Hard failures are typically a total loss of transmitter power, receiver gain or no antenna scan. Turn off system. Should the system be left on, further damage to other system components could occur.

Hard Failures:

Annunciation	Failure
TX FLT	Transmitter failure
429 FLT	Loss of 429 bus data
ANT FLT	Loss of antenna position
IN FLT 6	Loss of communication between display and ART

***Note:** A TX FLT is indicated if the Strut switch is configured to be active and the aircraft is on the ground.*

Soft failures are those which can cause limited system operation, Radar data will still be displayed but the flight crew should be aware that the display does not necessarily represent the true weather. Soft failures are typically configuration problem, stabilization problems, or some similar problem.

Soft Failures:

Annunciation	Cause
TX FLT alternating with ANT FLT	Configuration module not being read
STAB LMT	Stab. Is exceeding ±30˚
STAB OFF	Alert that the scan is not being stabilized

PREFLIGHT

PREFLIGHT WARNINGS

Do not turn the radar on within 5 feet of containers of flammable or explosive material. The radar should never be operated during fueling.

Do not attempt to operate the radar until you are completely familiar with all safety information, including that on pages 58 through 61.

The system always transmits in the ON mode, unless the aircraft is on the ground and the radar is interfaced to the strut switch. The radar transmits in LOG mode if the radar is not interfaced to a Bendix/King radar graphics unit. The system never transmits in the OFF, SBY or TST modes.

Accomplish the following procedures completely and exactly.

1) Place the radar controls in the following positions:
   - Function switch to TST
   - Tilt to UP 7 (as shown on the indicator display, upper right corner).

   The test pattern will appear. See that the test pattern conforms to the illustration (The test pattern is sized to fit the 80 nm range and can be scaled with the range buttons), and observe the "update" action as a small ripple moves across the display along the outer edge.

THEORY OF OPERATION

GENERAL

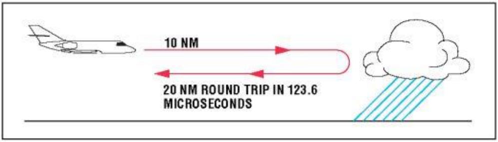
The primary use of this radar is to aid the pilot in avoiding thunderstorms and associated turbulence. Since each operator normally develops specific operational procedures for use of weather avoidance radar, the following information is presented for use at the operator's discretion.

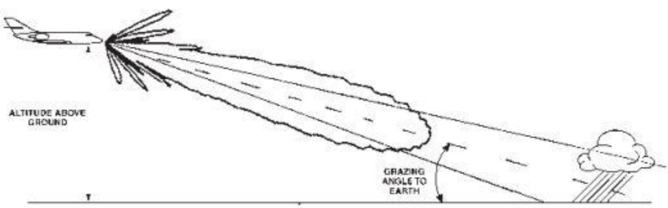
Operational techniques for the RDR 2000 are similar to earlier generation weather avoidance radars. The proficient operator manages antenna tilt control to achieve best knowledge of storm height, size, and relative direction of movement.

RADAR PRINCIPLES

Radar is fundamentally a distance measuring system using the principle of radio echoing. The term RADAR is an acronym for RAdio Detecting and Ranging. It is a method for locating targets by using radio waves. The transmitter generates microwave energy in the form of pulses. These pulses are then transferred to the antenna where they are focused into a beam by the antenna. The radar beam is much like the beam of flashlight. The energy is focused and radiated by the antenna in such a way that it is most intense in the center of the beam with decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. When a pulse intercepts a target, the energy is reflected as an echo, or return signal, back to the antenna. From the antenna, the returned signal is transferred to the receiver and processing circuits located in the receiver transmitter unit. The echoes, or returned signals, are displayed on an indicator.

Radio waves travel at the speed of 300 million meters per second and thus yield nearly instantaneous information when echoing back. Radar ranging is a two-way process that requires 12.36 micro-seconds for the radio wave to travel out and back for each nautical mile of target range. As shown in the distance illustration below, it takes 123.6 micro-seconds for a transmitted pulse of radar energy to travel out and back from an area of precipitation 10 nautical miles away.

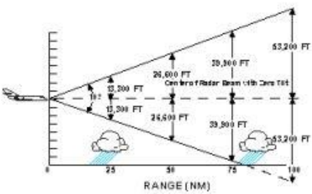




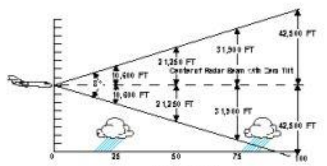
This tool should be understood and kept handy when trying to interpret the weather display.This tool illustrates that at greater distances, the weather cell doesn't fill the cone shaped beam. Under these conditions the distinction of the weather cell from the ground clutter is most difficult. The following figure illustrates this condition.

In this scenario the weather cell might be at 100 nm, the altitude might be 40,000 feet, and the appropriate tilt angle is approximately -3 degrees. Notice that the beam is centered on the rain but it also intersects the ground. The angle the beam makes with the ground is called the grazing angle. When this angle gets greater than about 2 degrees the ground reflections that return to the radar become very significant. A later section called "Tilt Management" discusses this difficult topic and makes some suggestions to help make weather/ground distinction.

The following diagrams show the beam width relationship with 10 inch, and 12 inch antennas. For illustrative purposes the aircraft are shown at approximately 40,000 feet and the tilt is set at zero degrees.



Radar Beam Illumination with 10 Inch Antenna



Radar Beam Illumination with 12 Inch Antenna

RADAR REFLECTIVITY

What target will reflect the radar's pulses and thus be displayed on the indicator? Only precipitation (or objects more dense than water such as earth or solid structures) will be detected by an X-band weather radar. Therefore weather radar does not detect clouds, thunderstorms or turbulence directly. Instead, it detects precipitation which may be associated with dangerous thunderstorms and turbulence. The best radar reflectors are raindrops and wet snow or hail. The larger the raindrop the better it reflects. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong echo. Drop size is the most important factor in high radar reflectivity. Generally, ice, dry snow, and dry hail have low reflective levels and often will not be displayed by the radar.

A cloud that contains only small raindrops, such as fog or drizzle, will not produce a measurable radar echo. But if the conditions should change and the cloud begins to produce rain, it will be displayed on radar.

WEATHER DISPLAY CALIBRATION

The radar display has been calibrated to show five levels of target intensity: Black (level 0), Green (level 1), Yellow (level 2), Red (level 3), and Magenta (level 4). The meaning of these levels is shown in the following chart as to their approximate relationship to the Video Integration Processor (VIP) intensity levels used by the National Weather Service. These levels are valid only when: (1) the Wx and WxA mode are selected; (2) the displayed returns are within the STC range of the radar (approximately 40 miles); (3) the returns are beam filling; (4) there are no intervening radar returns.

Display Level	Rainfall Rate		Video Integrated Processor (VIP) Categorizations				Remarks
			Storm Category	VIP Level	Rainfall Rate		
	mm/Hr.	In./Hr.			mm/Hr.	In./Hr.	
4 (Magenta)	Greater Than 50	Greater Than 2	Extreme	6	Greater Than 125	5	Severe turbulence, large hail, lightning, extensive wind gust, and turbulence.
			Intense	5	50-125	2-5	Severe turbulence, lightning,organized wind gusts, hail likely.
3 (Red)	12-50	0.5-2	Very Strong	4	25-50	1-2	Severe turbulence likely, lightning.
			Strong	3	12-25	0.5-1	Severe turbulence, possible lightning.
2 (Yellow)	4-12	0.17-0.5	Moderate	2	2.5-12	0.1-0.5	Light to moderate turbulence is possible with lightning.
1 (Green)	1-4	0.04-0.17	Weak	1	0.25-2.5	.01-0.1	Light to moderate turbulence is possible with lightning.
0 (Black)	Less Than 1	Less Than 0.04					

Radar Display and Thunderstorm Levels Versus Rainfall Rates

WEATHER ATTENUATION COMPENSATION

An extremely important phenomena for the weather avoidance radar operator to understand is that of attenuation. When a radar pulse is transmitted into the atmosphere, it is progressively absorbed and scattered so that it loses its ability to return to the antenna. This attenuation or weakening of the radar pulse is caused by two primary sources, distance and precipitation. The RDR 2000 has several advanced features which significantly reduce the effects of attenuation (no airborne weather radar can eliminate them completely). It is therefore up to the operator to understand the radar's limitations in dealing with attenuation.

Attenuation because of distance is due to the fact that the radar energy leaving the antenna is inversely proportional to the square of the distance. For example, the reflected radar energy from a target 60 miles away will be one fourth (if the target is beam filling) of the reflected energy from an equivalent target 30 miles away. The displayed effect to the pilot is that as the storm is approached, it will appear to be gaining in intensity. To compensate for distance attenuation both Sensitivity Timing Control (STC) and Extended STC circuitry are employed. The RDR 2000 has an STC range of 0 to approximately 40 nautical miles. Additionally, the radar will electronically compensate for the effects of distance attenuation with the net effect that targets do not appear to change color as the distance decreases.

Outside the STC range the Extended STC circuitry increases the displayed intensity to more accurately represent storm intensity. The Extended STC will not, however, totally compensate for distance attenuation and, therefore, targets in this range can be expected to show more detail as the distance decreases until reaching the STC range.

Attenuation due to precipitation is far more intense and is less predictable than attenuation due to distance. As the radar pulses pass through moisture, some radar energy is reflected. But much of that energy is absorbed. If the rain is very heavy or extends for many miles, the beam may not reach completely through the area of precipitation. The weather radar has no way of knowing if the beam has been fully attenuated or has reached the far side of the precipitation area. If this beam has been fully attenuated the radar will display a "radar shadow" which appears as an end to the precipitation when, in fact, the heavy rain may extend for many more miles. In the worst case, precipitation attenuation may cause the area of heaviest precipitation to be displayed as the thinnest area of heavy precipitation. It may cause one cell containing heavy precipitation to totally block or shadow a second heavy cell located behind the first cell and prevent it from being displayed on the radar. **Never fly into radar shadows** and never believe that the full extent of heavy rain is being seen on radar unless another cell or a ground target can be seen beyond the heavy cell. Proper use of the antenna tilt control can help detect radar shadows.

OPERATION IN-FLIGHT

GENERAL

The RDR 2000 will provide you with target information to a greater degree of clarity than has ever been possible with previous generation weather avoidance radars. It is the purpose of this section to help you become a proficient radar operator as soon as possible. However, it is realized that proficiency can only improve with usage. It is, therefore, recommended that the operator become familiar with the operation of the system during fair weather instead of while trying to penetrate a storm front.

In previous sections of this handbook we have described the various controls and discussed the features of the RDR 2000 radar system. This section concerns itself with a more detailed discussion of some of these controls and how to make the most efficient use of them.

Note: *Your radar is a weather-avoidance device. It should never be used for weather-penetration. It will help you see and plan avoidance maneuvers around significant weather encountered during flight.*

TILT MANAGEMENT

P11 Effective antenna tilt management is the single, most important key to more informative weather radar displays. Three prime factors must be kept in mind for proper tilt management:

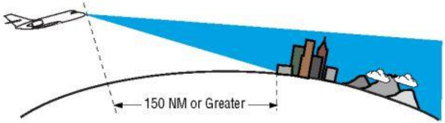
- The earth's curvature must be considered in determining the location of the beam at long distances.
- The center of the radar beam is referenced to the horizon by the aircraft vertical reference system.
- Adjusting the antenna tilt control will cause the center of the radar beam to scan above or below the plane of the attitude reference system.

More simply, a too low setting will result in excessive ground or sea returns while a too high tilt setting (although excessive returns are eliminated) can result in the radar beam passing over the top of a weather target.

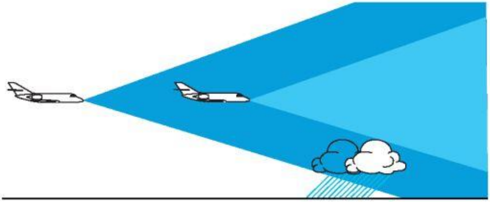
For detecting weather targets at long ranges and to allow adequate time for planning the proper avoidance path, the tilt angle should be set for a sprinkle of ground target returns on the display. By slowly raising the tilt angle, weather targets will emerge from the ground returns because of their height above the ground. In order to minimize ground returns when closely examining weather targets below the aircraft flight level, select the shortest range that allows full depiction of the area of interest.

In practice, when flying over fairly even terrain, ground returns are difficult to paint when the angle of incidence of the radiated beam becomes large (see Looking Angle pg. 22) and, therefore, causes the beam to travel almost parallel to the ground (see figure below.)

However, objects such as large buildings in cities, steep hills, mountains or storms will reflect the signal and can show strong returns at distances greater than those shown below.



Ground Returns and Tilt Management



Over-scanning and Tilt Management

When flying at high altitudes, the use of proper tilt management ensures observation of weather targets without over scanning. For example, a low altitude storm detected on the long range setting may disappear from the display as it is approached. While it may have dissipated during your approach toward the storm, don't count on it. It may be that you are directing the radiated energy from the antenna above the storm as you get closer. Judicious management of the antenna tilt control will avoid over-scanning a weather target.

Note: Please be aware that equivalent ground returns will require different tilt settings because of different ground reflectivities (for example, dry soil requires a different tilt setting than the more reflective tropical forest).

EARLY DETECTION OF ENROUTE WEATHER

To set the antenna tilt to optimize the radar's ability to quickly identify significant weather, follow these steps:

P12

1) Select the Wx (weather) mode of operation. Adjust Brightness control as desired.

2) Select the 40 or 80 nm range.

3) Adjust the antenna tilt control down until the entire display is filled with ground returns.

4) Slowly work the antenna tilt up so that ground returns are painted on or about the outer one third of the indicator area.

5) Watch the strongest returns seen on the display. If, as they are approached, they become weaker and fade out after working back inside the near limit of the general ground return pattern, they are probably ground returns or insignificant weather. If they continue strong after working down into the lower half of the indicator, you are approaching a hazardous storm or storms and should deviate immediately.

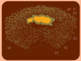
6) Examine the area behind strong targets. If radar shadows are detected you are approaching a hazardous storm or storms and should deviate immediately, regardless of the aircraft's altitude. If weather is being detected, move the antenna tilt control up and down in small increments until the return object is optimized. At that angle, the most active vertical level of the storm is being displayed.

7) If a target is suspected to be a weather cell, but is partially obscured by clutter, move the track line over the target and select Vertical Profile. If the target is clutter, it will appear symmetrical about the ground return. If the target is weather, it will be asymmetrical and appear above the ground return (see the section on Vertical Profile for more information on this technique).

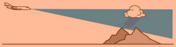
SEPARATION OF WEATHER AND GROUND TARGETS

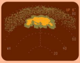
One of the most difficult tasks when using airborne weather radar is separating weather targets from ground targets. This is especially true since the maximum return from a storm cell occurs when the radiation beam is centered on the rainfall shaft. In many cases, this shaft may be no higher than 5,000 feet thus requiring some antenna down tilt to observe it. If you are flying at an altitude considerably above this, the antenna beam will also intersect the ground, thus masking the storm cells with ground targets. Proper adjustment of the antenna tilt will assist you in target separation.

P13



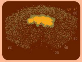
Significant weather will show a stronger return than ground return at shallow angles. A weather target will show as a solid mass while mountains will show a gap behind the peaks.

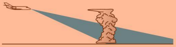


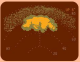


Raise tilt until a weather target emerges from the ground returns.

Raise tilt angle until weather is separated from the ground.







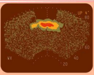
Note that displayed range of the ground target will increase as tilt angle is increased.

SHADOWED AREAS

Extremely heavy rainfall can reduce the ability of the radar energy to penetrate a weather cell and present a complete picture of the weather area. This condition is referred to as "radar attenuation". Under these conditions ground returns can be helpful in analyzing the weather situation. Tilt the antenna down and observe the ground returns around the displayed cell. If no ground returns are displayed on the far side of the displayed cell (shadowed area), heavy rain may be blocking the radar energy. This could mean that a larger area of precipitation exists than that which is displayed.

WARNING: AVOID AND NEVER PENETRATE A SHADOWED AREA.

P05



TARGET RESOLUTION

The ability of a weather avoidance radar system to resolve and display two or more closely spaced targets is limited in range by the transmitted pulse width and display range and in azimuth by the antenna beam width.

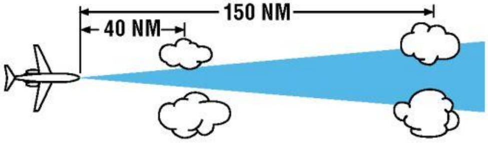
RANGE RESOLUTION

The transmitter pulse width in the RDR 2000 is 4 micro-seconds, yielding a receiver range resolution of approximately 1/3 nautical mile.

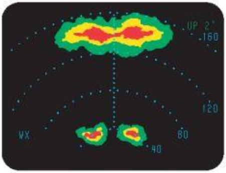
AZIMUTH RESOLUTION

The ability of the radar to resolve adjacent targets in azimuth is a function of the beam width of the antenna and the range to the target. As can be seen in the adjacent table, the diameter of this radiated beam increases as it gets further away from the aircraft.

Antenna Size	Beam Width	25 NM	50 NM	100 NM	200 NM
		Beam Diameter (NM)			
10"	10.0°	4	8	16	32
12"	8.0°	3	6	12	24



Targets separated by a distance less than the beam diameter (at the target distance) will merge and appear on the indicator as "one."



PATH PLANNING

Remember to plan a deviation path early. Simply skirting the red or magenta portion of a cell is not enough. Plan an avoidance path for all weather echoes which appear beyond 100 nautical miles since this indicates they are quite intense.

The most intense echoes are severe thunderstorms. Remember that hail may fall several miles from the cloud, and hazardous turbulence may extend as much as 20 nautical miles; therefore, echoes should be separated by at least 40 nautical miles before you fly between them. As echoes diminish in intensity, you can reduce the distance by which you avoid them.

PATH PLANNING CONSIDERATIONS

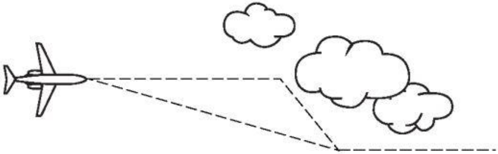
P14

- Avoid cells containing magenta and red areas by at least 20 nautical miles.

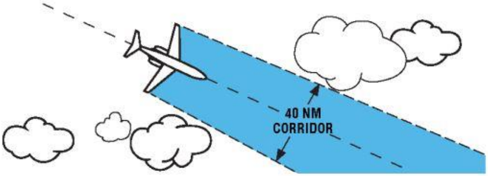
- Do not deviate downwind unless absolute necessary. Your chances of encountering severe turbulence and damaging hail are greatly reduced by selecting the upwind side of the storm.

- If looking for a corridor, remember corridors between two cells containing magenta and/or red areas should be at least 40 nautical miles wide from the outer fringes of the radar echo. The magenta displays areas of very heavy rainfall and statistically indicates a high probability of hail.

Note: *Do not approach a storm cell containing magenta and red any closer than 20 nautical miles. Echoes should be separated by at least 40 nautical miles before attempting to fly between them.*



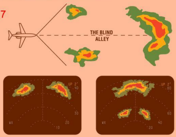
Cells beyond 75 nautical miles are areas of substantial rainfall, do not wait for red or magenta to appear. Plan and execute evasive action quickly to minimize "doglegging."



When a complete detour is impractical, penetration of weather patterns may be required. Avoid adjacent cells by at least 20 nautical miles .

A "Blind Alley" or "Box Canyon" situation can be very dangerous when viewing the short ranges. Periodically switch to longer-range displays to observe distant conditions. As shown below, the short-range returns show an obvious corridor between two areas of heavy rainfall but the long-range setting shows a larger area of heavy rainfall.

P17



ANTENNA STABILIZATION

CRITERIA

Automatic antenna stabilization, as employed in today's weather avoidance radar, consists of an electro-mechanical means of maintaining a selected beam scan relative to the earth's horizon during moderate aircraft maneuvers. To accomplish this, a reference is established by the aircraft's vertical gyro, usually a component of the auto pilot or integrated flight control system.

Any aircraft may experience a noticeable amount of gyro drift during extended periods of turning flight. If you do encounter a vertical gyro which precesses abnormally during maneuvering flight (as evidenced on the artificial horizon in either pitch or roll) but subsequently precesses to normal attitude during straight and level flight, degrading gyro performance is indicated. This type of poor gyro performance does not usually result in a catastrophic gyro failure, but rather a continued gradual degradation.

PITCH ERRORS

As the aircraft accelerates during takeoff, the gyro will precess in pitch. As soon as the aircraft speed becomes steady, the accrued pitch error will start diminishing. Average time required for the gyro to stabilize after takeoff will vary with acceleration time and rate. Acceleration and deceleration on approach can also cause the gyro to precess slightly. This precession problem is greater on jet aircraft because of their rapid acceleration capabilities.

TURN ERRORS

If a turn is accomplished after takeoff while the gyro is off vertical due to takeoff acceleration, the pitch error will be translated into the roll axis and will be observed as a roll attitude error when compared to the natural horizon. The roll error starts disappearing the moment the aircraft resumes straight and level flight.

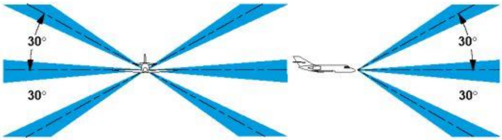
In turns made with less than a 6 degree bank (for example, intercepting a VOR with a shallow cut), the gyro continues to sense the lateral acceleration (lateral force) and, as a result, precesses in the same direction as the bank. If the turn is continued at the same indicated bank angle, the actual bank assumed by the aircraft will steepen at the same rate the gyro is precessing. When the aircraft is returned to straight flight and brought to wings level via the turn-and-bank indicator or the natural horizon (if visible) the roll error accumulated during the turn will be observed on the horizon indicator and will remain for a period of time unless a fast recovery technique is employed.

DURING TAKEOFF

Since there is no advantage in having the antenna tilt level while at low altitudes, raising the antenna tilt to clear ground returns caused by gyro acceleration error will result in satisfactory radar operation. Tilt can then be readjusted as the vertical gyro stabilizes. Turns during climb-out, while pitch acceleration error exists, will also cause a stabilization error in the roll axis.

SHALLOW-BANKED TURNS

If the aircraft is held in a shallow bank attitude, gyro precession will cause ground returns to appear. This can be overcome by raising the antenna tilt 1 or 2 degrees until the aircraft is out of the turn and the gyro has stabilized. In addition to any gyro error, radar stabilization is further affected by antenna mechanical limits of ±30 degrees.

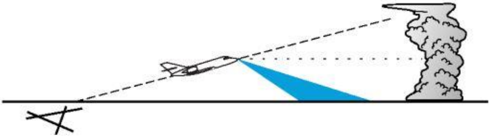


STABILIZATION LIMITS

Stabilization limitations of the antenna beam may be exceeded during aircraft maneuvers. These limitations are mechanically fixed at 30 degrees from zero degrees. Combinations of pitch/roll and tilt which exceed this limitation will diminish stabilization effectiveness. Pitch/roll is a complex quantity, not an arithmetic sum. However, as a rule-of-thumb, for small pitch angles, the sum of tilt and bank angles being less than 20 degrees, is within limits.

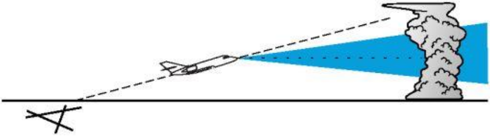
If the pilot changes the aircraft attitude so as to exceed the combined tilt, pitch and roll limits (±30 degrees) of the radar's stabilization system, the message, "STAB LMT", will appear at the lower right corner of the display during the time the limit is exceeded. Please note that during portions of the antenna sweep, the calculated antenna elevation angle may not exceed the limit. Therefore, the "STAB LMT" will not be displayed. The "STAB LMT" message will disappear completely when the aircraft attitude is restored to within the system's operational limits.

Gyro precession may be experienced during take-off or prolonged aircraft maneuvers such as rapid descents, etc. Precession error may introduce a three to five degree antenna stabilization error which may persist as long as 5 minutes after the maneuver. Precession error results in a "lopsided" antenna scan; low on one side, high on the other. If the picture is extremely "dirty" in the forward area-antenna looking at terrain rather than precipitation-use a slight degree of up tilt. In the azimuth scan area near 45° left or right, the beam tilt is close to that indicated.

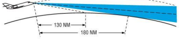


A rapid climb profile dictates that the tilt should not remain in the up position for extended periods. As the aircraft altitude progressively increases, the possibility of over scanning weather cells also increases. The effective storm height is progressively reduced by the aircraft altitude.

- Adjust radar and obtain weather picture before takeoff.
- Plan wide clearance of cells.
- Compensate antenna tilt for gyro precession.
- Evaluate weather in the immediate sphere of operation.
- Do not "over-scan" weather targets.
- During excessive aircraft maneuvers, recognize the limitations of stabilization.



Stabilization of the radar beam compensates for moderate aircraft maneuvers. The Line-of-Sight system used is not absolute, but has limitations. Recognize limitation errors. Errors in the order of one-half degree or less can produce this effect. With the beam just contacting the horizon at 180 nautical miles, a 1/2 degree of further down tilt moves this contact point in to 130 nautical miles. Isolated terrain targets would now appear.



Introducing a 1/2 degree roll error compounds the effects; down on one side, up on the other side (1 degree unbalance).

STABILIZATION FLIGHT TEST CHECKLIST

1. Fly the aircraft being tested to 10,000 feet AGL .
2. Select the MAP mode, STAB OFF, and set the indicator to 20 nm.
3. Set manual gain to maximum.
4. While flying level (0 degree pitch, 0 degree roll), adjust the tilt control for a video pattern shown in Figure 1.

Note: Record tilt position for future reference.

5. If the inner ring of video is not parallel to the range marks, the mounting of the antenna is not parallel to the horizontal axis of the aircraft.

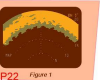


Figure 1

6. Turn the STAB on. If the pattern appears as Figure 2 or 3, the RDR 2000 can compensate for this using ROLL TRIM. Adjust the ROLL TRIM with a small screwdriver through access on radar indicator controller until figure 1 is achieved.

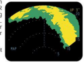


Figure 2

7. Roll the aircraft gently to the right auto pilot bank angle.

8. For perfect stabilization, the pattern shown in Figure 1 should not shift. The information displayed will change, however, the inner extremity should remain coincident with the third range mark.

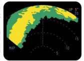


Figure 3

9. If the pattern shifts as shown in Figure 2, increase the tilt angle until the edge of the video pattern reaches the same position as the center was before the roll maneuver. Note the new position of the tilt control. Proceed to step 11.

Figure 4

10. If the pattern shifts as shown in Figure 3, decrease the tilt angle until the edge of the video pattern reaches the same position as the center was before the roll maneuver. Note the new position of the tilt control. Proceed to step 11.

11. If the differences between Steps 9 and 4 or 10 and 4 are greater than 2 degrees the system should be ground checked to recalibrate the roll stabilization circuitry to the gyro.

12. If the pattern shifts per Figure 4, there is no roll stabilization and the system should be ground checked per the Installation Manual.

13. Check pitch performance as follows: Re-establish Figure 1 by flying straight and level. Momentarily pitch the aircraft up 5 degrees (no more than 10 to 20 seconds to minimize altitude change). If the inner ring of clutter moves further out in range, readjust the tilt downward until the pattern returns as it was before the pitch maneuver. Note the tilt change. If the clutter moved inward, adjust the tilt upward and note the change. If the tilt change is greater than 2 degrees, the system should be ground checked to recalibrate the pitch.

VERTICAL PROFILE (VP) THEORY OF OPERATION

Note: A VP compatible indicator is required to display in VP mode.

The primary use of the RDR 2000 is to aid the pilot in avoiding thunderstorms and associated turbulence. All normal weather radar principals apply to the Vertical Profile feature incorporated in the RDR 2000 radar. It is therefore important to become familiar with the theories of basic radar principles, beam illumination, radar reflectivity, display calibration, weather attenuation compensation, weather mapping and interpretation, ground mapping and target resolution.

The operational difference between the standard weather avoidance radar and the RDR 2000 is the additional ability to vertically scan the antenna up and down with respect to the aircraft center line and process the vertical slice of information for display in a meaningful format.

VP OPERATION IN-FLIGHT

VERTICAL PROFILE

The single most important key to deriving pertinent, usable information from weather radar is proper tilt management. This formerly complex procedure is greatly simplified by the RDR 2000 Vertical Profile feature.

With conventional non-VP weather avoidance radars, setting the antenna tilt angle too low results in excessive ground or sea returns. Setting the angle too high eliminates the excessive return problems, but may result in the radar beam passing over the top of a weather target. The proper antenna tilt angle is directly dependent on a given storm's range from the aircraft and its height, width, depth and intensity. Upon selecting the desired tilt, the pilot must rely on his ability to interpret the limited display information. For detailed information on tilt management and interpretation of display information, refer to the Tilt Management section under Operation In-Flight.

The Vertical Profile feature of the RDR 2000 provides a direct means of displaying the vertical characteristics of the weather cell. Storm characteristics of particular interest to the pilot include relative height, slant, shape, vertical development and the area of most concentrated precipitation within the storm. In addition to providing information about the storm's vertical characteristics, the pilot can now easily distinguish between ground or sea returns and actual weather. In dual indicator installations, the normal azimuth scan may be viewed on one indicator and Vertical Profile on the other. With this information at hand, the pilot can develop a mental, three-dimensional picture of the storm.

P24

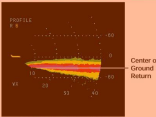


Figure 5: Vertical Profile View
Ground Returns
Aircraft at 20,000 feet MSL

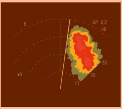


Figure 5A:
Standard Azimuth View
Aircraft at 20,000 feet MSL

Figure 5: 40 nm range selected showing normal ground returns over that terrain. The aircraft is at 20,000 feet MSL. The flashlight like beam image provides a good representation of the radar beam characteristics. The center line of this image is the ground. As the beam is scanned over the ground the solid returns create a mirror image above and below the ground level providing reflectivity equal to the beam width and power level. As aircraft altitude and range increase, the ground returns will decay in much the same way as they increased from where the beam first intersected the ground.

P25

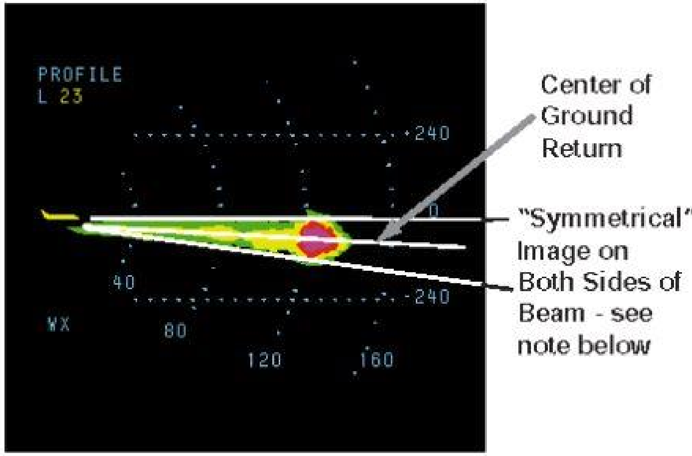


Figure 6: Vertical Profile View
Ground Mapping Denver & Mountains
Aircraft at 20,000 feet MSL

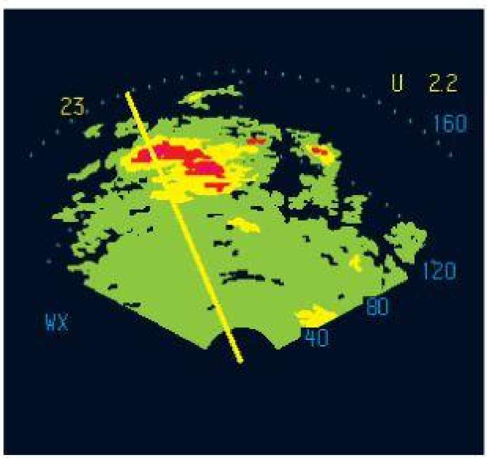


Figure 6A: Standard Azimuth View
Ground Mapping Denver & Mountains
Aircraft at 20,000 feet MSL

Figure 6: 160 nm range selected showing normal ground returns over flat terrain with Denver and the background mountains displayed as strong symmetrical ground returns at 130 nautical miles. The aircraft is at 20,000 feet MSL. When the beam shows a symmetrical image about the ground return center line, either the returns are from a very solid object such as the ground or a very intense low level close in storm.

Note: The image will be symmetrical in ground map mode and slightly truncated at the bottom side of the return in Wx Mode.

P26

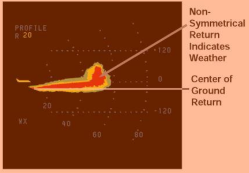


Figure 8
Vertical Profile View
Strong Weather Line
Aircraft at 20,000 feet MSL

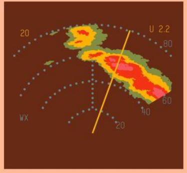


Figure 8A
Standard Azimuth View
Strong Weather Line
Aircraft at 20,000 feet MSL

Figure 8: 80 nm range selected showing normal ground returns out to 60 nautical miles. An intense high-level storm is depicted by the non-symmetrical returns. The aircraft is at 20,000 feet MSL.

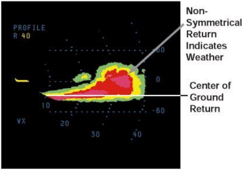


Figure 9: Vertical Profile View
Strong Weather Returns
Aircraft at 20,000 feet MSL

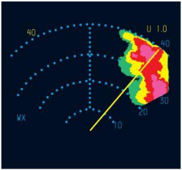


Figure 9A: Standard Azimuth View
Strong Weather Returns
Aircraft at 20,000 feet MSL

Figure 9: 40 nm range selected showing normal ground returns out to 25 nautical miles. At 20 nautical miles the RDR 2000 shows an area of isolated precipitation between the aircraft and the major storm which starts at 25 nautical miles. This "Roll Cloud" is a fairly typical phenomenon associated with severe weather. The aircraft is at 20,000 feet MSL.

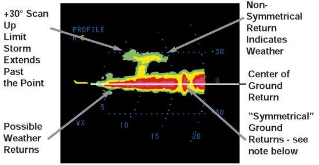


Figure 10: Vertical Profile View
Low Level Weather & Ground Returns
Aircraft on Ground at Fort Collins
Loveland, Colorado

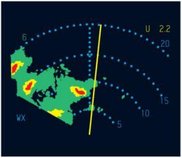


Figure 10A: Standard Azimuth View
Low Level Weather Ground Returns
Aircraft on Ground in Fort Collins
Loveland Colorado

Note: The image will be symmetrical in ground map mode and slightly truncated at the bottom side of the return in Wx Mode.

Figure 10: 20 nm range selected, aircraft on the ground at Fort Collins Loveland, Colorado airport. Strong symmetrical ground returns are depicted out to 20 nautical miles. A shaft of precipitation approximately 3 nautical miles wide starts at 9 nautical miles, rises and mushrooms. An interesting point to note between the azimuth and VP presentation is the

storm depth painted. The Vertical Profile presentation depicts the storm tops to be 7 nautical miles deep while the azimuth view depicts a storm depth of 2 nautical miles. The selected tilt angle would account for this discrepancy. The vertical scan in the Vertical Profile mode of operation is up and down 30 degrees. Normal azimuth scan tilt adjustment is up and down 15 degrees, which limits the upward scan and ability to paint the higher level development of the storm as depicted in Vertical Profile presentation.

Between 3 and 5 nautical miles the low altitude areas of precipitation are detected. Due to their proximity to the ground and aircraft, sufficient returns are detected to provide the symmetrical returns we normally associate with ground returns.

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006-08755-0001 Printed in USA
Revision 3 5/98

AlliedSignal