## Session I. NASA Flight Tests

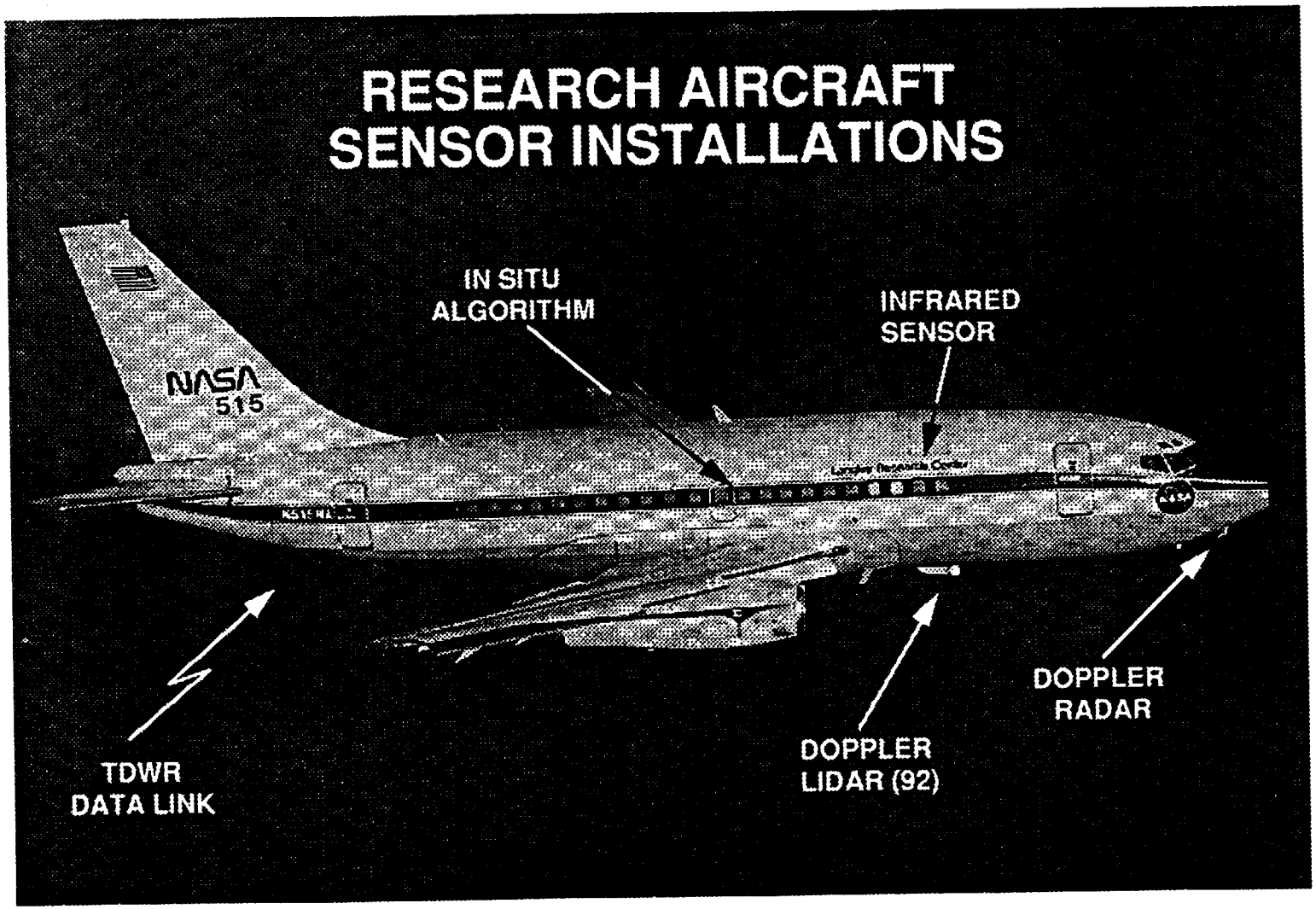


### Flight Test Operations

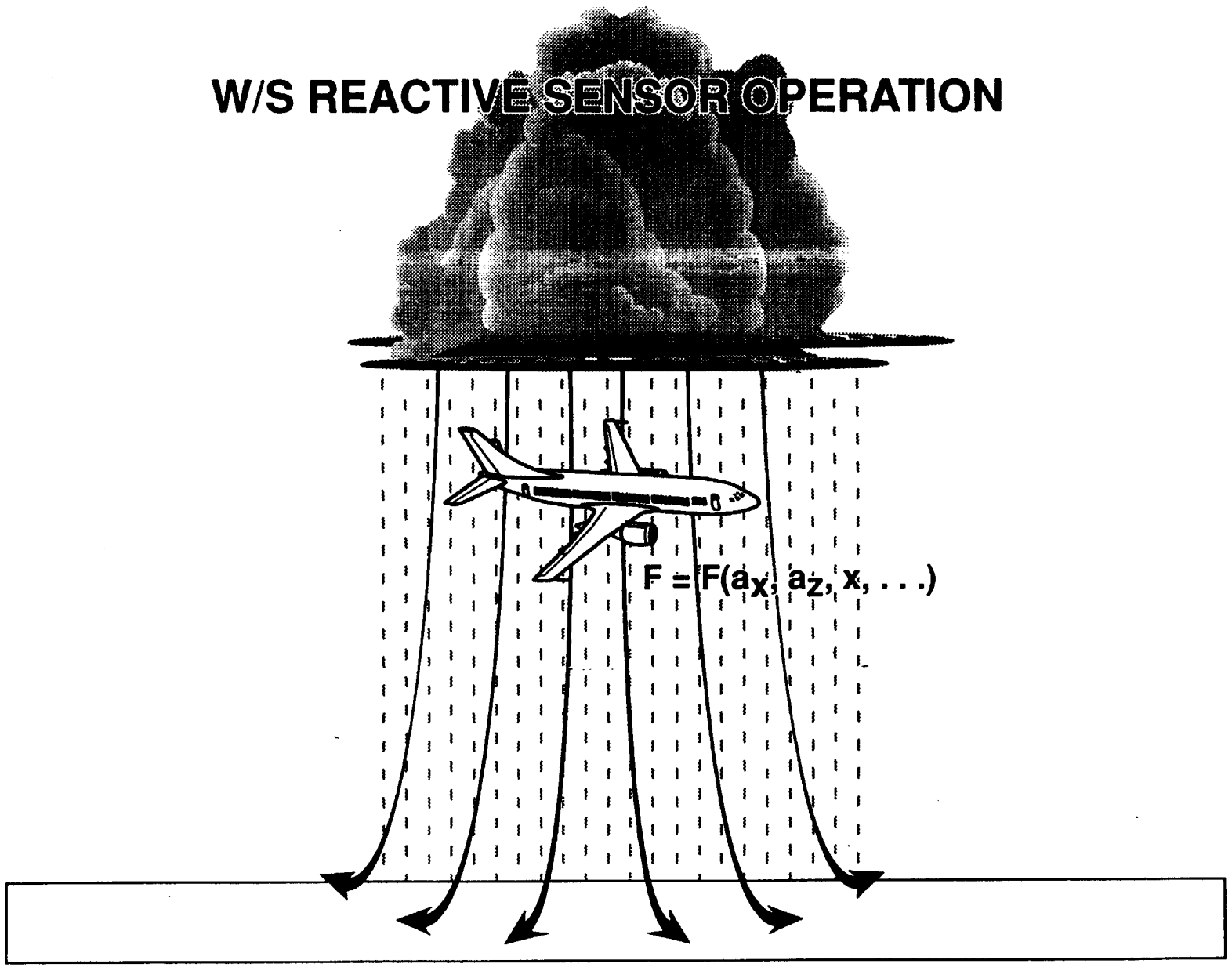
**Mike Lewis**, NASA Langley Research Center

## WIND SHEAR PROGRAM

# WIND SHEAR AIRBORNE SENSORS PROGRAM



# W/S REACTIVE SENSOR OPERATION



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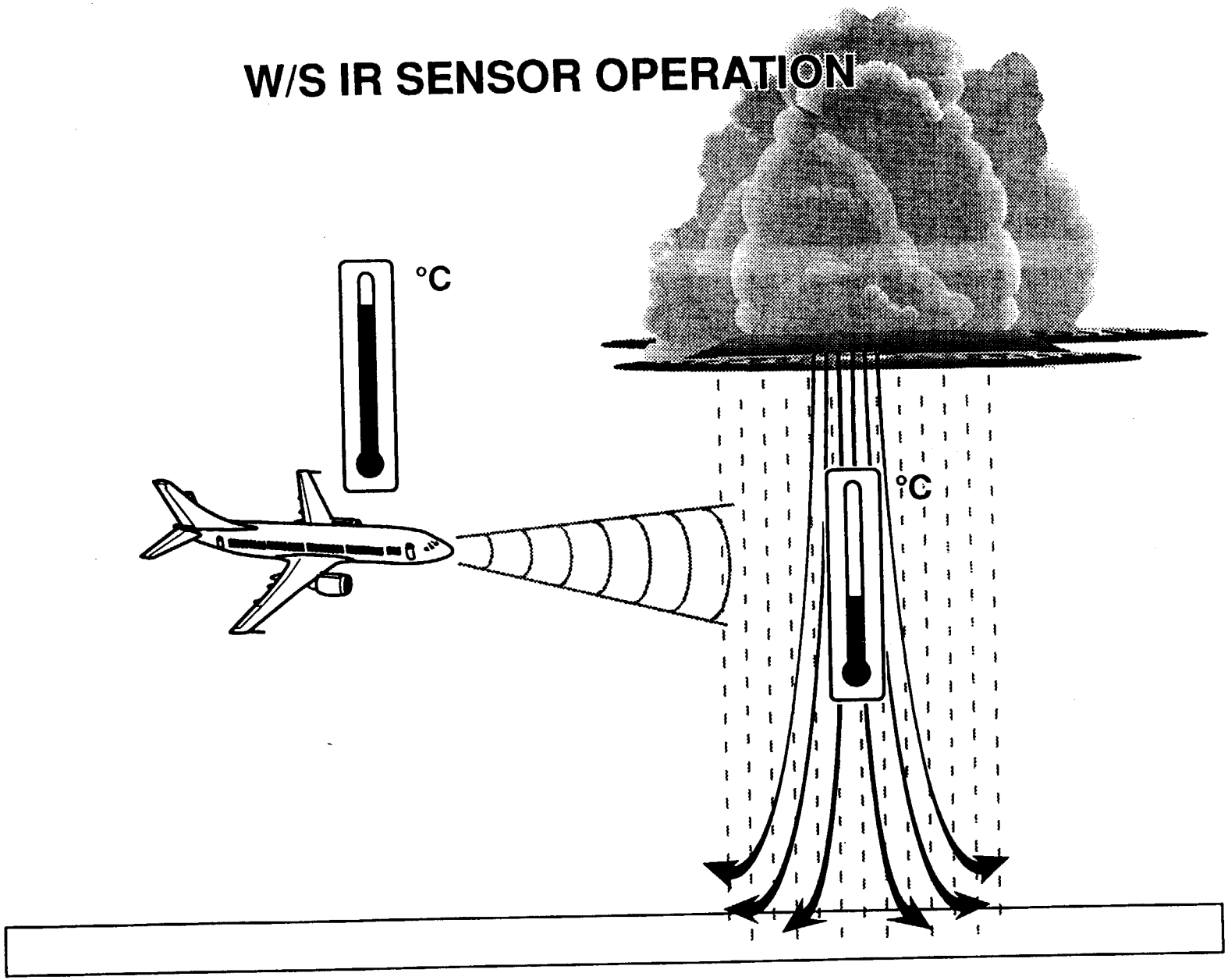
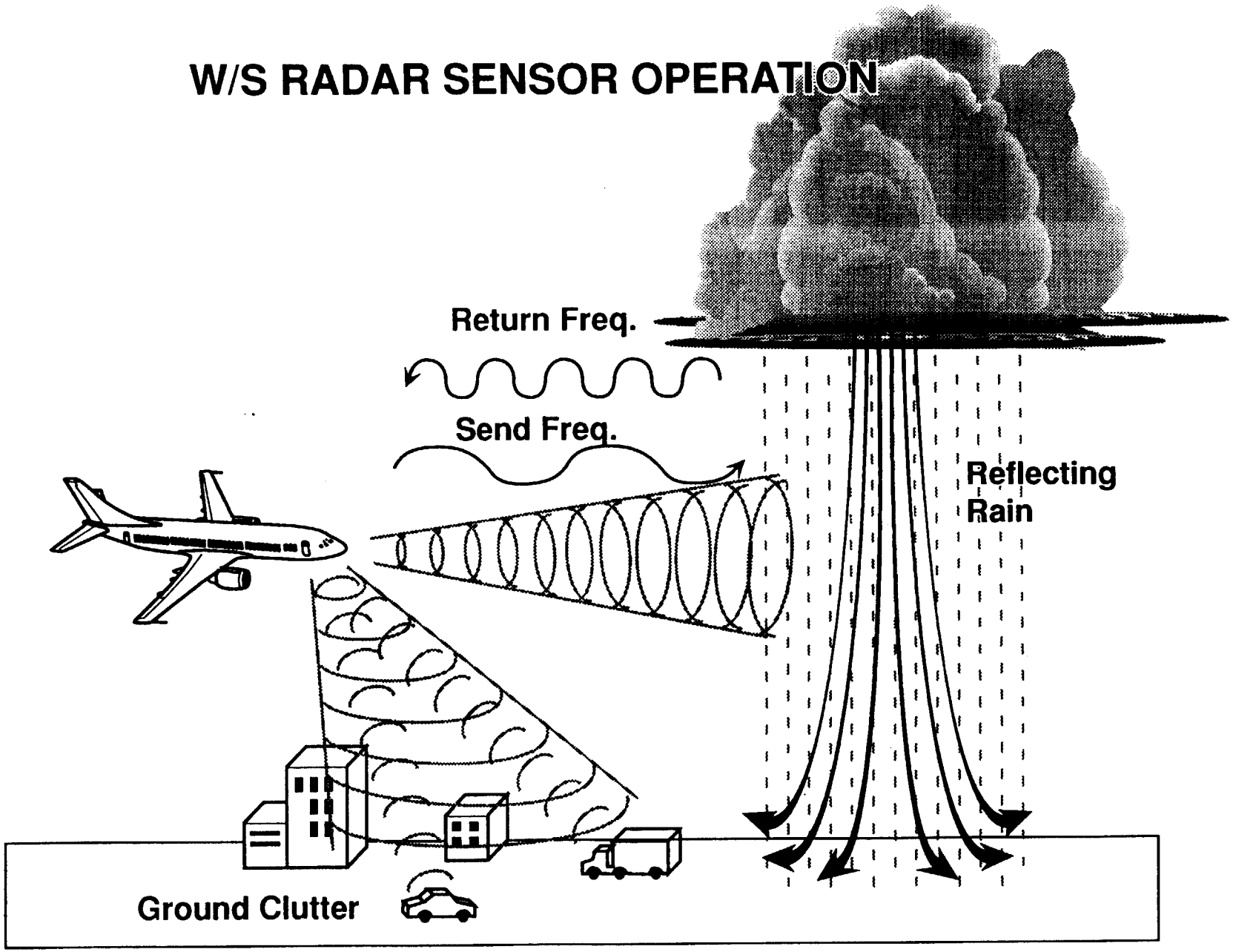


# W/S RADAR SENSOR OPERATION



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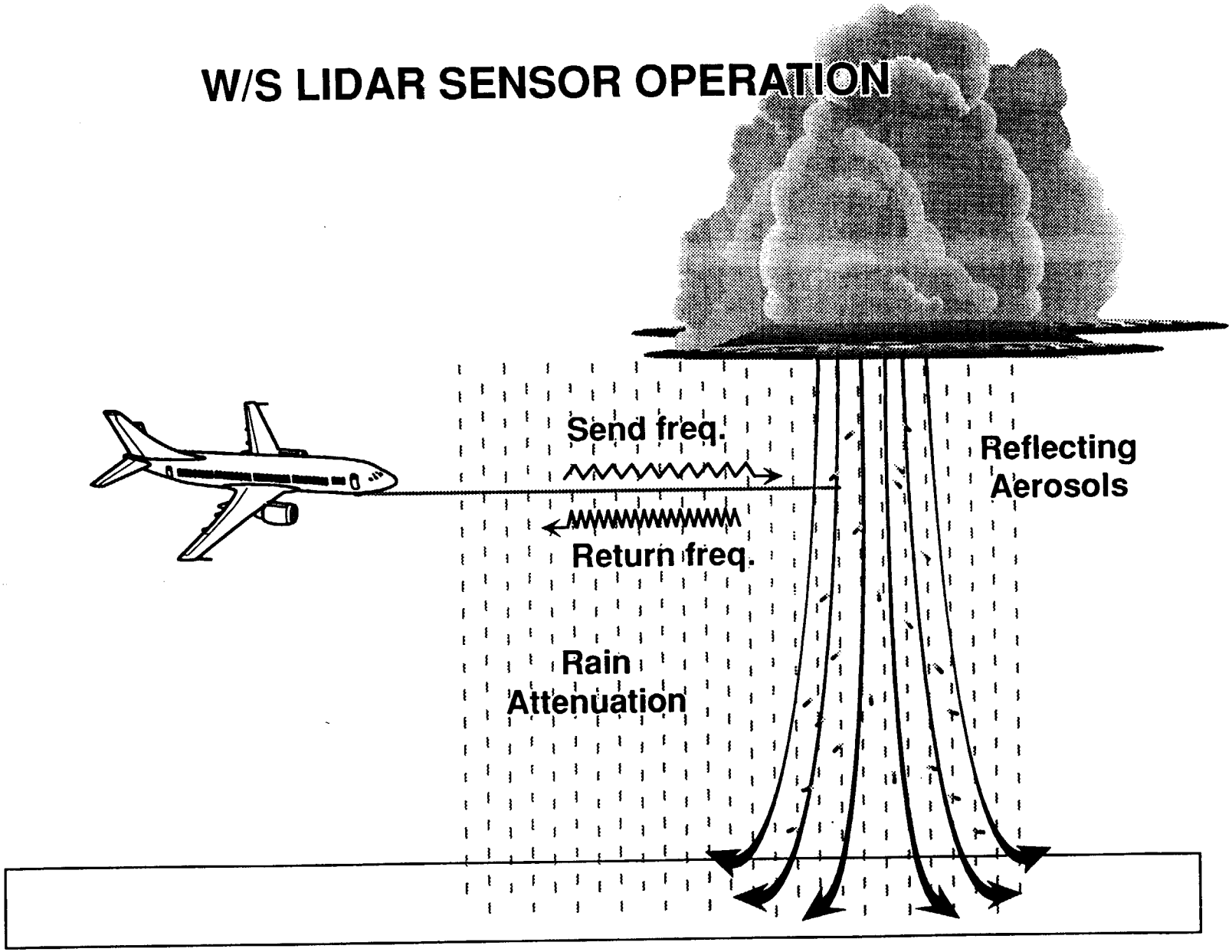
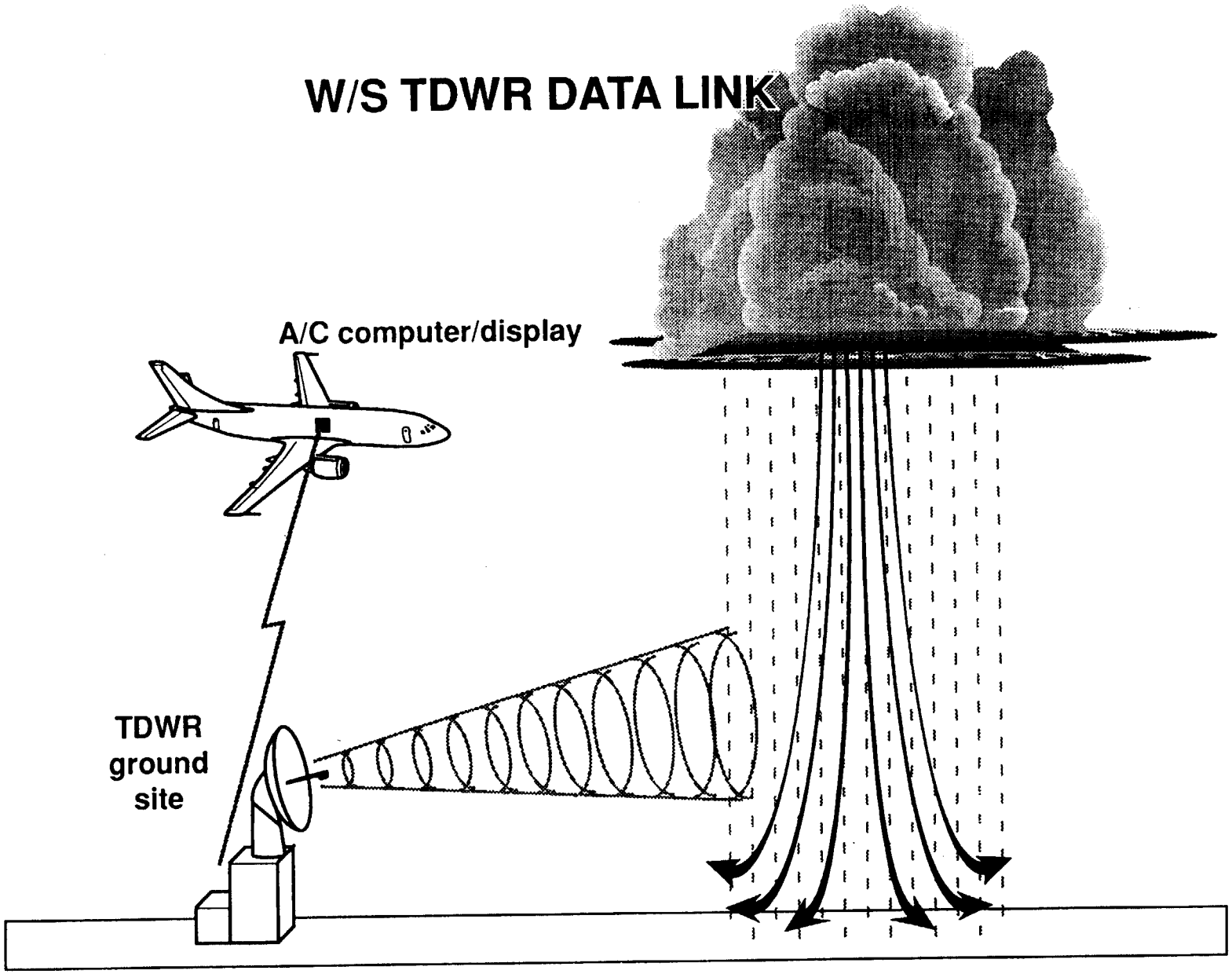



I/LDR SNSR|92-784

# W/S TDWR DATA LINK




I/W/S TDWR|92-784

# 1991 FLIGHT TEST SUMMARY

- **INSTRUMENT SYSTEM CHECKOUT ( - 2/91)**
- **CLEAR WEATHER DATA FLIGHTS (2/91 -4/91)**
- **LOCAL IN/NEAR WEATHER FLIGHTS (5/91)**
- **DEPLOYMENT PREPARATION FLIGHTS (5/91)**
- **ORLANDO (6/91), DENVER (7/91) DEPLOYMENTS**
  - FULL SAFETY, FLIGHT OPERATIONS REVIEWS
  - ATC, GROUND SITE, TDWR PREPARATIONS
  - 50+ PERSONNEL AT EACH SITE

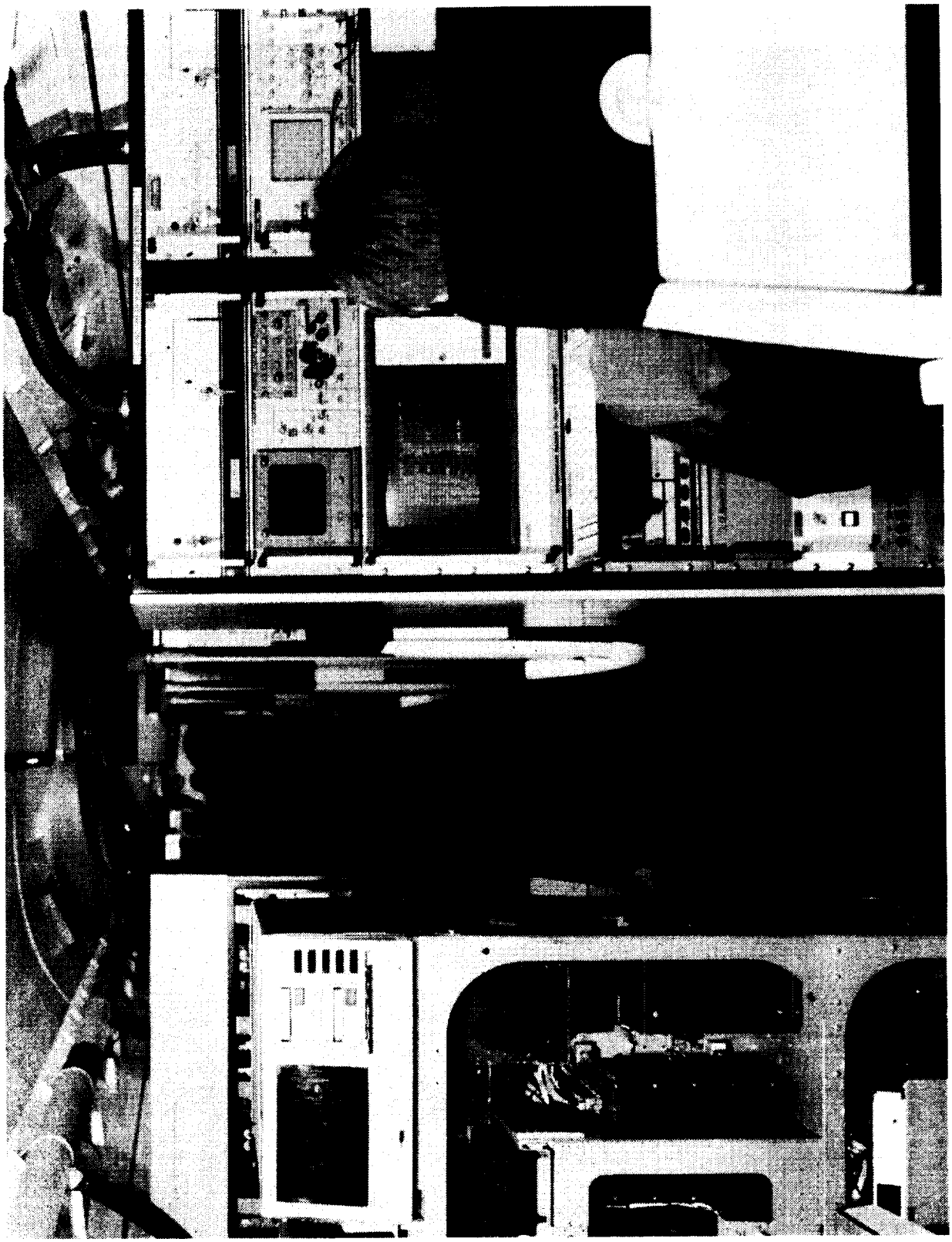
WIND SHEAR AIRBORNE SENSORS PROGRAM

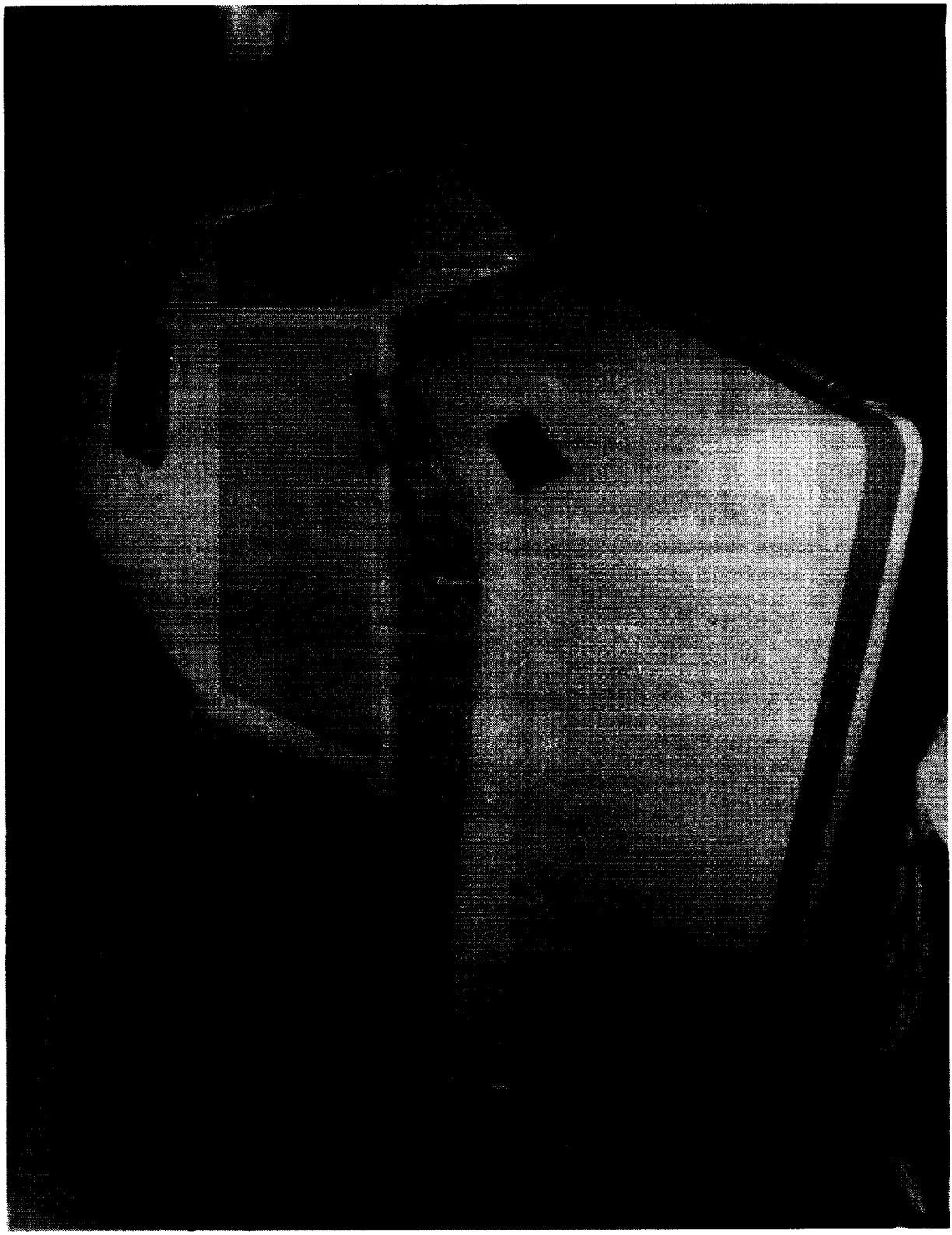
# 1991 DEPLOYMENT GOALS

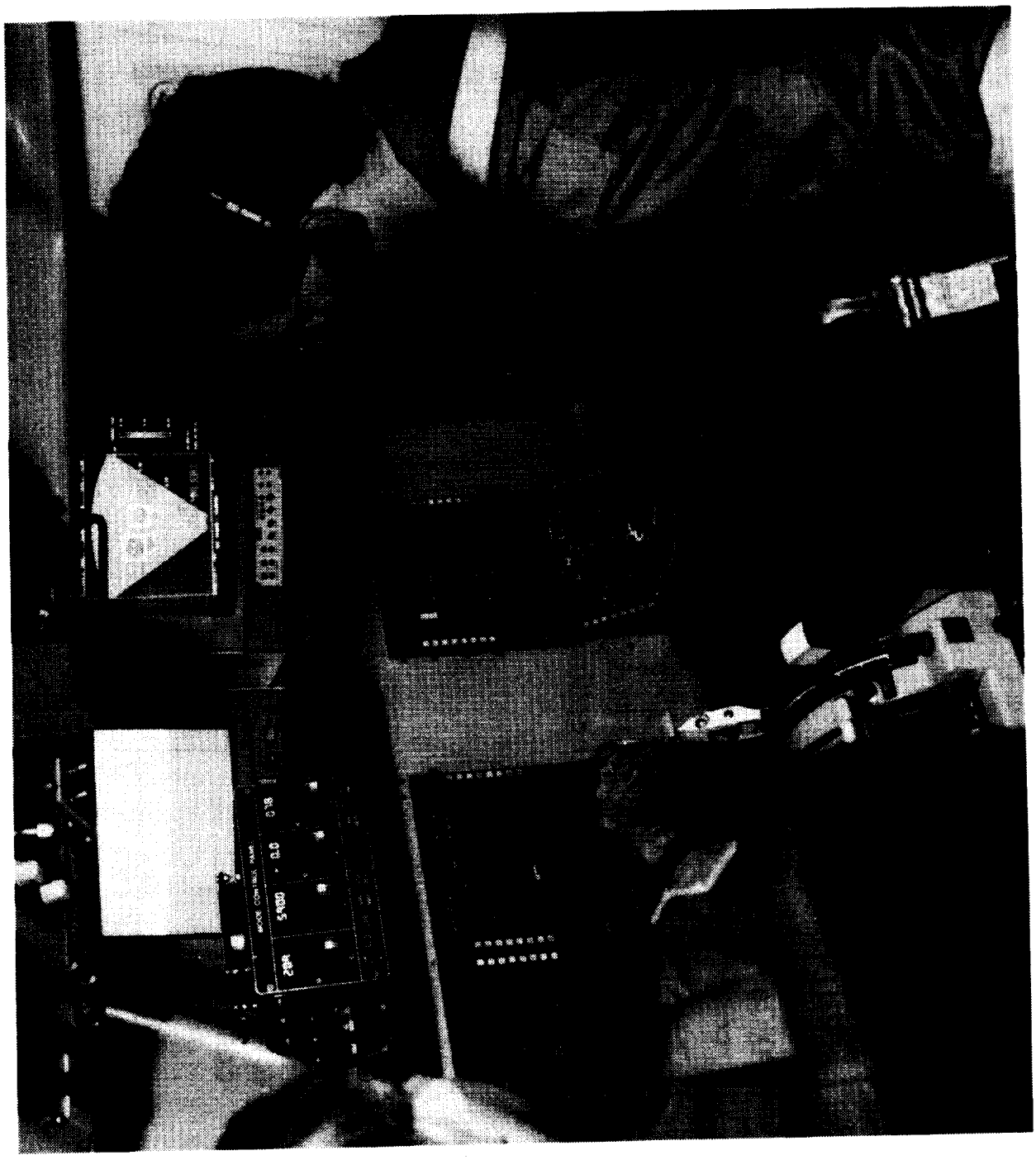
1.) EVALUATE AND DEMONSTRATE OPERATIONAL FEASIBILITY OF TDWR/AIRCRAFT DATA COMMUNICATION AND AIRBORNE ALGORITHM PERFORMANCE

2.) CONDUCT REAL APERTURE RADAR MEASUREMENT OF FIXED AND MOVING CLUTTER

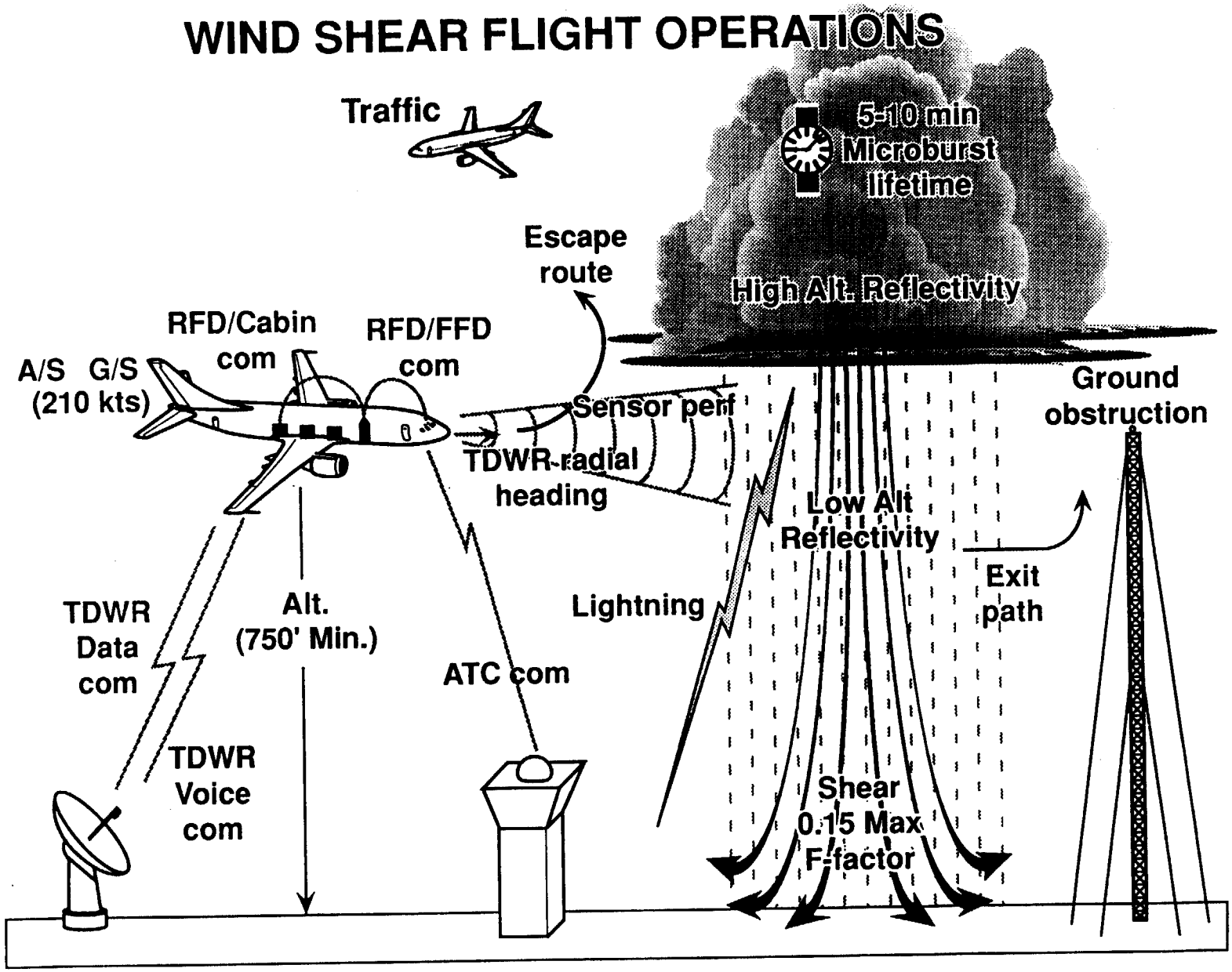
3.) TEST AND EVALUATE WIND SHEAR DETECTION PERFORMANCE OF CANDIDATE AIRBORNE SYSTEMS IN REALISTIC ATMOSPHERIC AND OPERATIONAL CONDITIONS

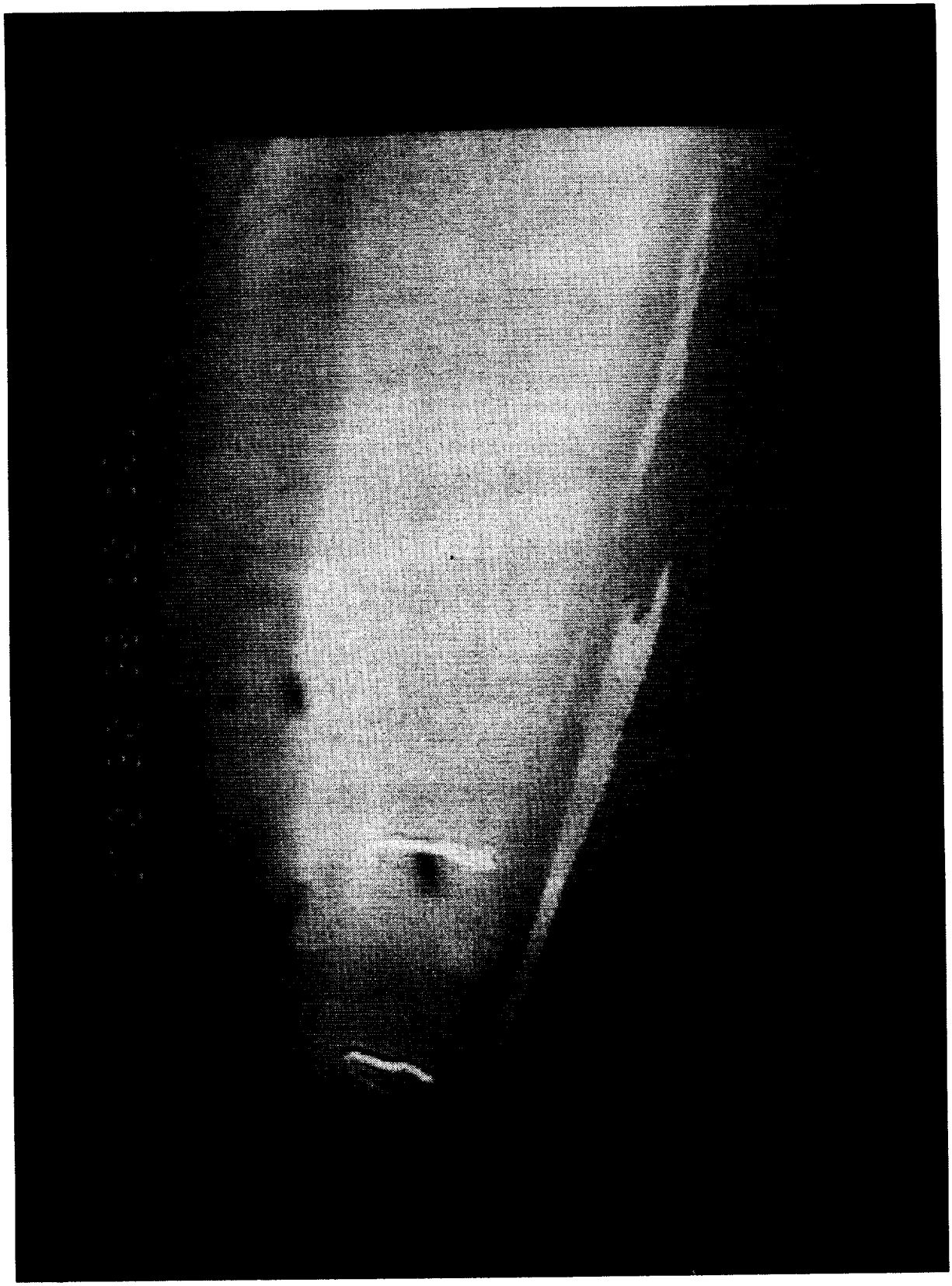


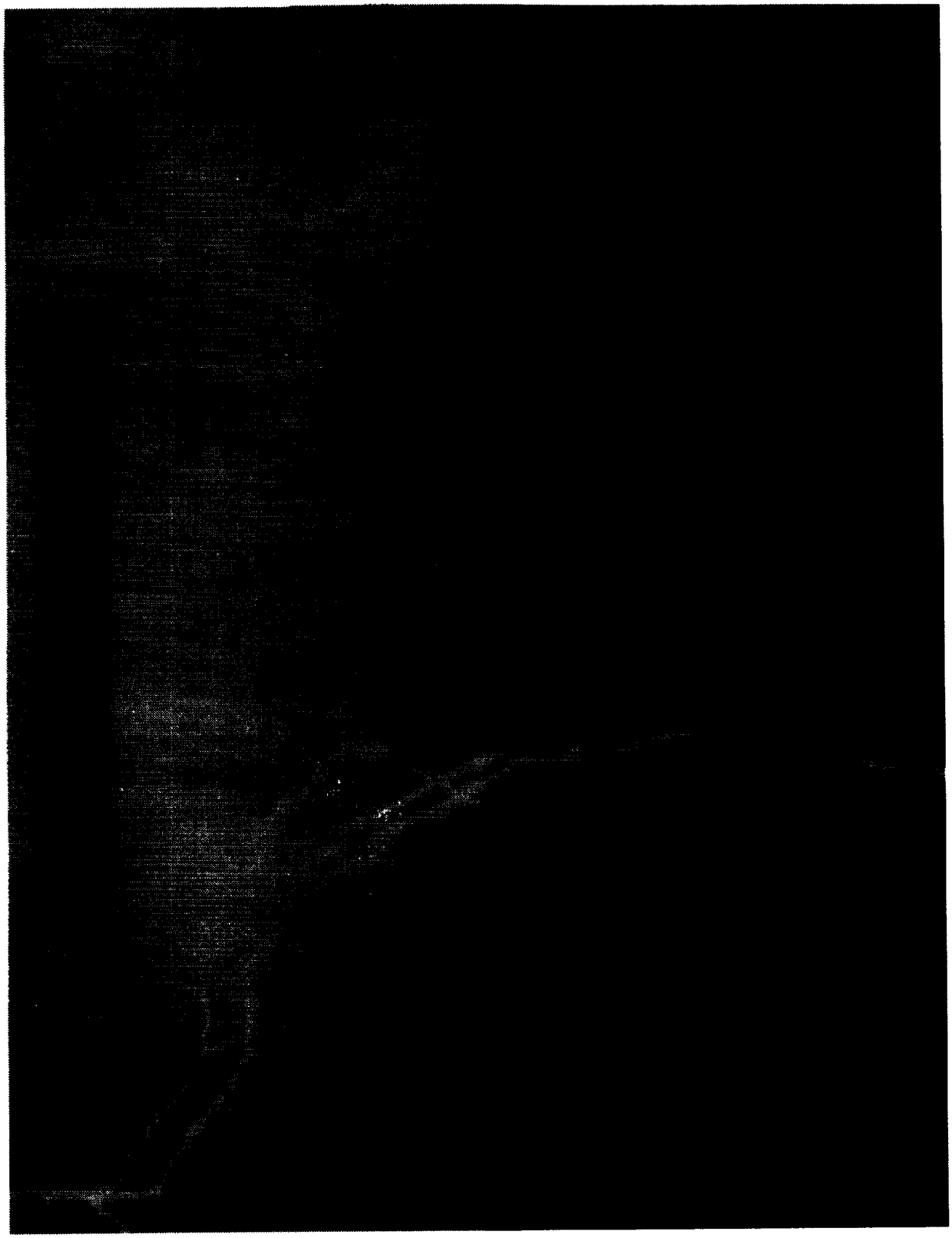


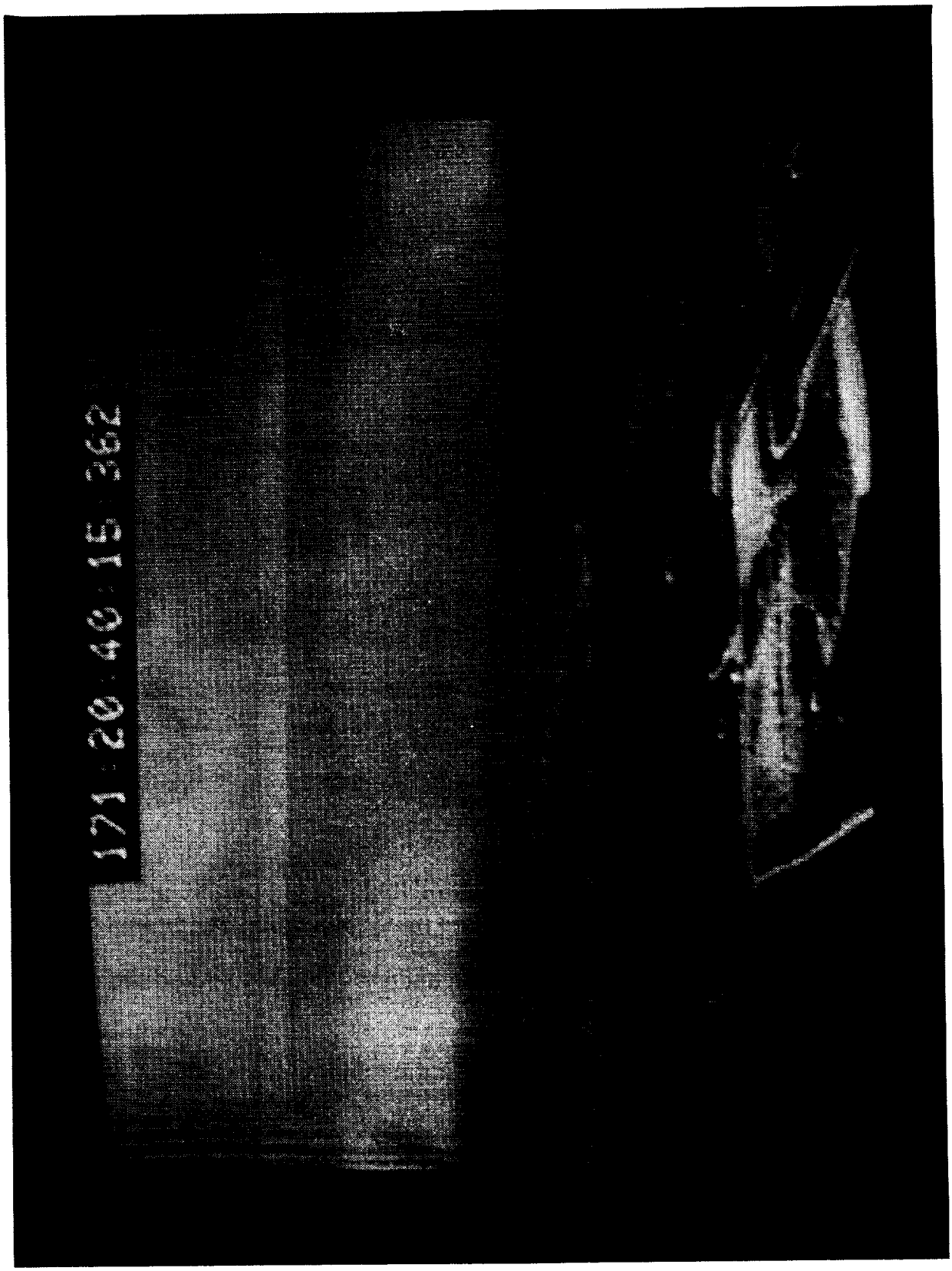


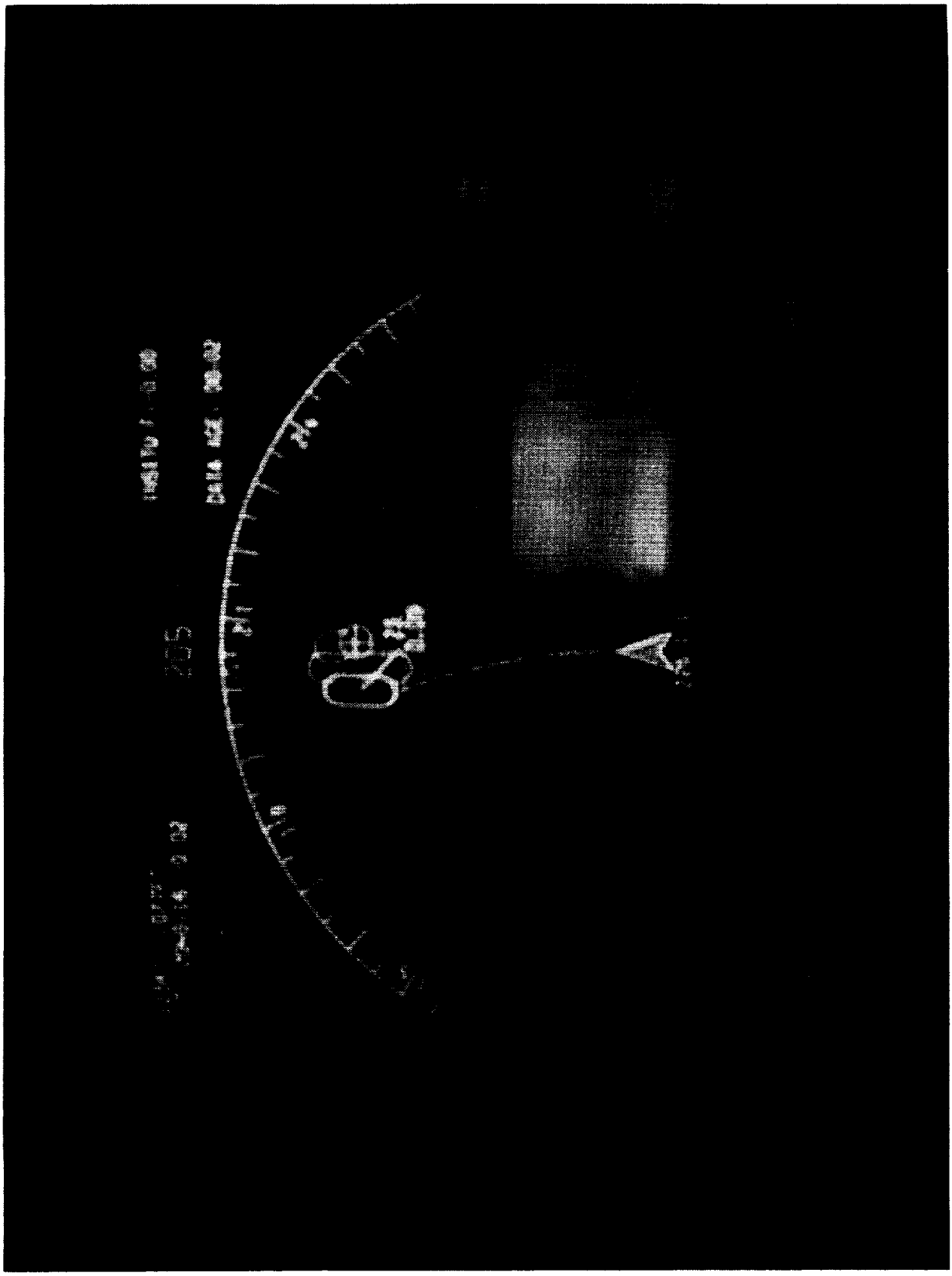
# WIND SHEAR FLIGHT OPERATIONS











WIND SHEAR AIRBORNE SENSORS PROGRAM

# 1991 DEPLOYMENT GOALS/ACCOMPLISHMENTS

1.) EVALUATE AND DEMONSTRATE OPERATIONAL FEASIBILITY OF TDWR/AIRCRAFT DATA COMMUNICATION AND AIRBORNE ALGORITHM PERFORMANCE

- **FEASIBILITY AND UTILITY OF TDWR DATA LINK DEFINITIVELY DEMONSTRATED**

2.) CONDUCT REAL APERTURE RADAR MEASUREMENT OF FIXED AND MOVING CLUTTER

- **100% OF REQUIRED AIRPORT CLUTTER DATA COLLECTED**

3.) TEST AND EVALUATE WINDSHEAR DETECTION PERFORMANCE OF CANDIDATE AIRBORNE SYSTEMS IN REALISTIC ATMOSPHERIC AND OPERATIONAL CONDITIONS WITH ALL VARIABLES PRESENT

- **MULTIPLE SHEAR APPROACHES AND PENETRATIONS FLOWN**
  - **APPROX. 19 MICROBURST WIND SHEAR PENETRATIONS, >30 RAIN SHAFT (WEAK DIVERGENCE) PENETRATIONS, >5 PROXIMITY APPROACHES TO LARGE STORM CELLS**
  - **APPROXIMATELY 8 STRONG GUST FRONT PENETRATIONS**
  - **MAXIMUM IN SITU F-FACTOR ENCOUNTERED = 0.17, MINIMUM = -0.24**
- **CLASSIC 'DRY' TYPE MICROBURST NOT ENCOUNTERED IN DENVER, THOUGH DRY GUST FRONT MEASUREMENTS PROVIDE NEARLY EQUIVALENT DATA**

WIND SHEAR AIRBORNE SENSORS PROGRAM

# 1991 TEST RESULTS SUMMARY

- ACQUIRED OUTSTANDING HIGH RESOLUTION MEASUREMENTS OF MICROBURST DYNAMICS AND STRUCTURE
- ACCOMPLISHED FIRST EVER IN SITU DETECTION SYSTEM CORRELATION WITH INDEPENDENT MEASUREMENTS
- ACCOMPLISHED FIRST EVER AIRBORNE RADAR DETECTION OF HAZARDOUS WIND SHEAR
- HIGH QUALITY CLUTTER MEASUREMENTS PROVIDE BASIS FOR NATIONAL CERTIFICATION STANDARDS
- DEMONSTRATED PERFORMANCE BENEFITS AND UTILITY OF TDWR DATA LINK CONCEPT

WIND SHEAR AIRBORNE SENSORS PROGRAM

# 1992 FLIGHT TESTS EXPECTATIONS

- PULSED DOPPLER LIDAR SYSTEM ON BOARD
- FULL SENSOR COMPLEMENT INSTALLED
- SIGNIFICANTLY ENHANCED RADAR PROCESSOR INSTALLED
- IR INSTRUMENT INCLUDES 1991 'LESSONS LEARNED'
- TDWR DATA LINK ENHANCED
- FLIGHT OPERATIONS TO INCLUDE 1991 'LESSONS LEARNED'
- LOCAL, ORLANDO, AND DENVER TEST SITES
- END-TO-END WIND SHEAR DETECTION PERFORMANCE EVALUATION
  - COMMON HAZARD PROCESSING
  - UNIFIED ALERTS
  - INTEGRATED DISPLAY