

1995

Session I. NASA Flight Tests

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Flight Test Operations

Mike Lewis, NASA Langley Research Center

WIND SHEAR PROGRAM

**JOINT NASA/FAA AIRBORNE
WIND SHEAR DETECTION AND
AVOIDANCE PROGRAM**

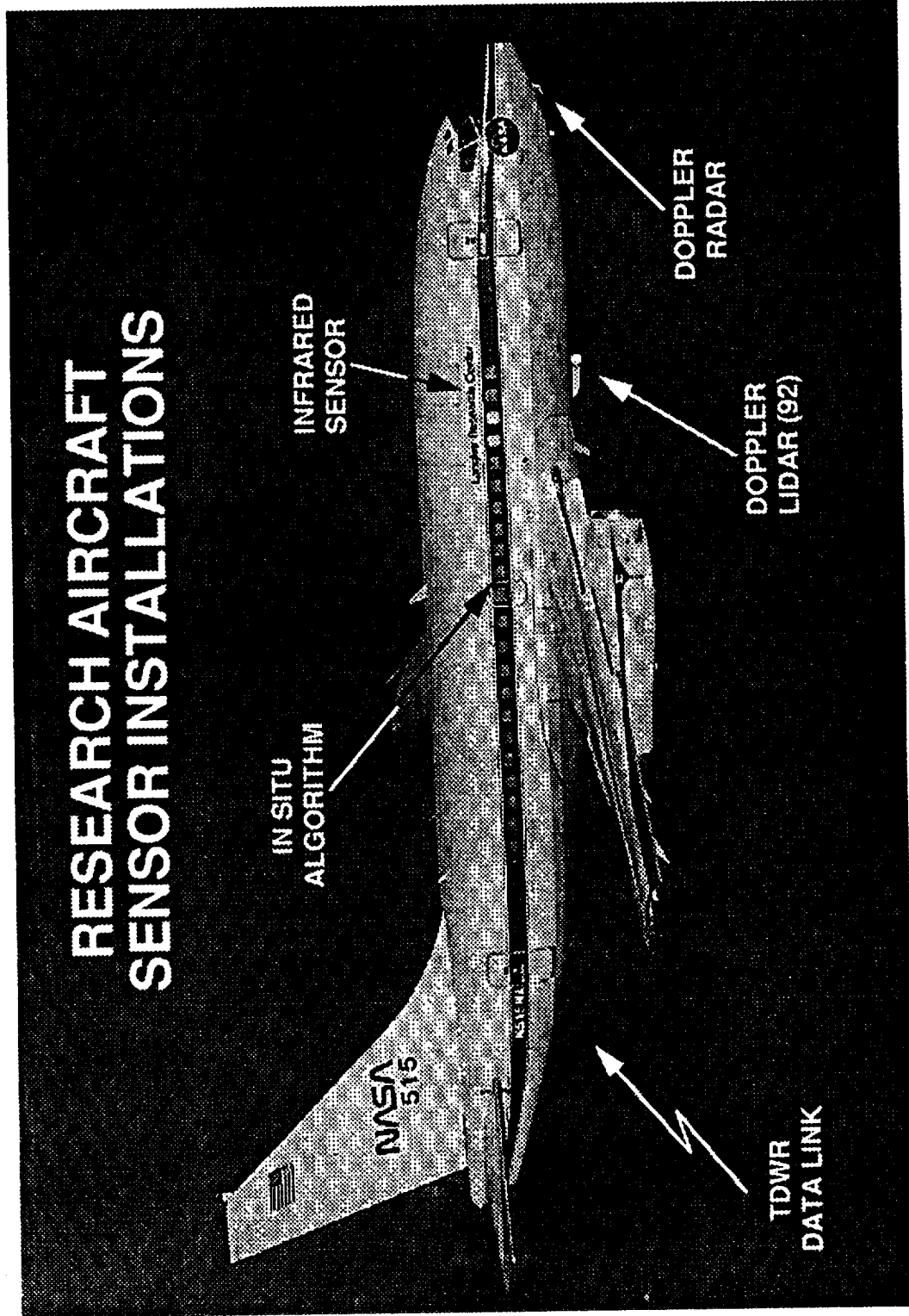


1991 FLIGHT EXPERIMENTS

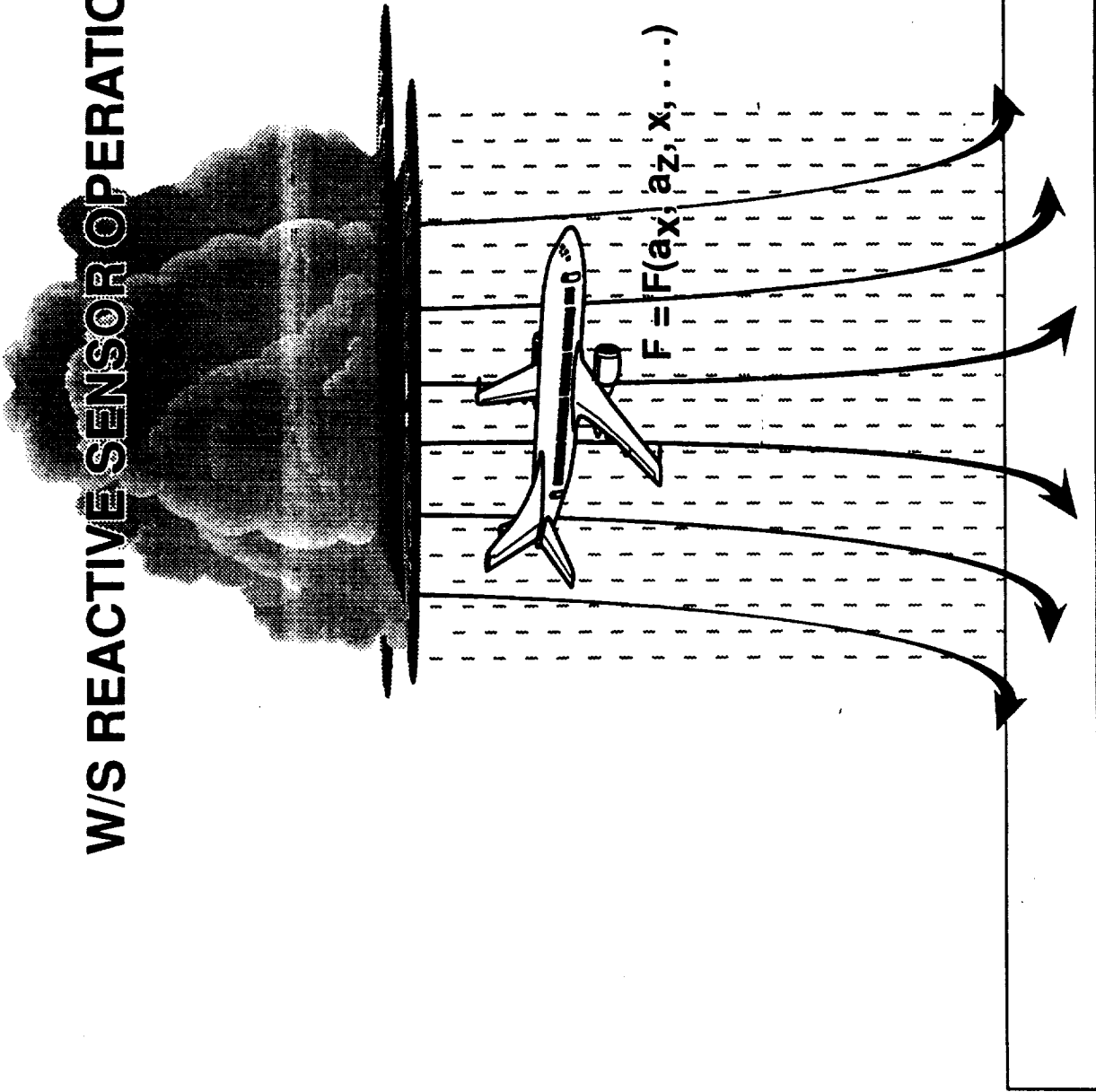
**Michael S. Lewis
Flight Systems Directorate
NASA Langley**

WIND SHEAR AIRBORNE SENSORS PROGRAM

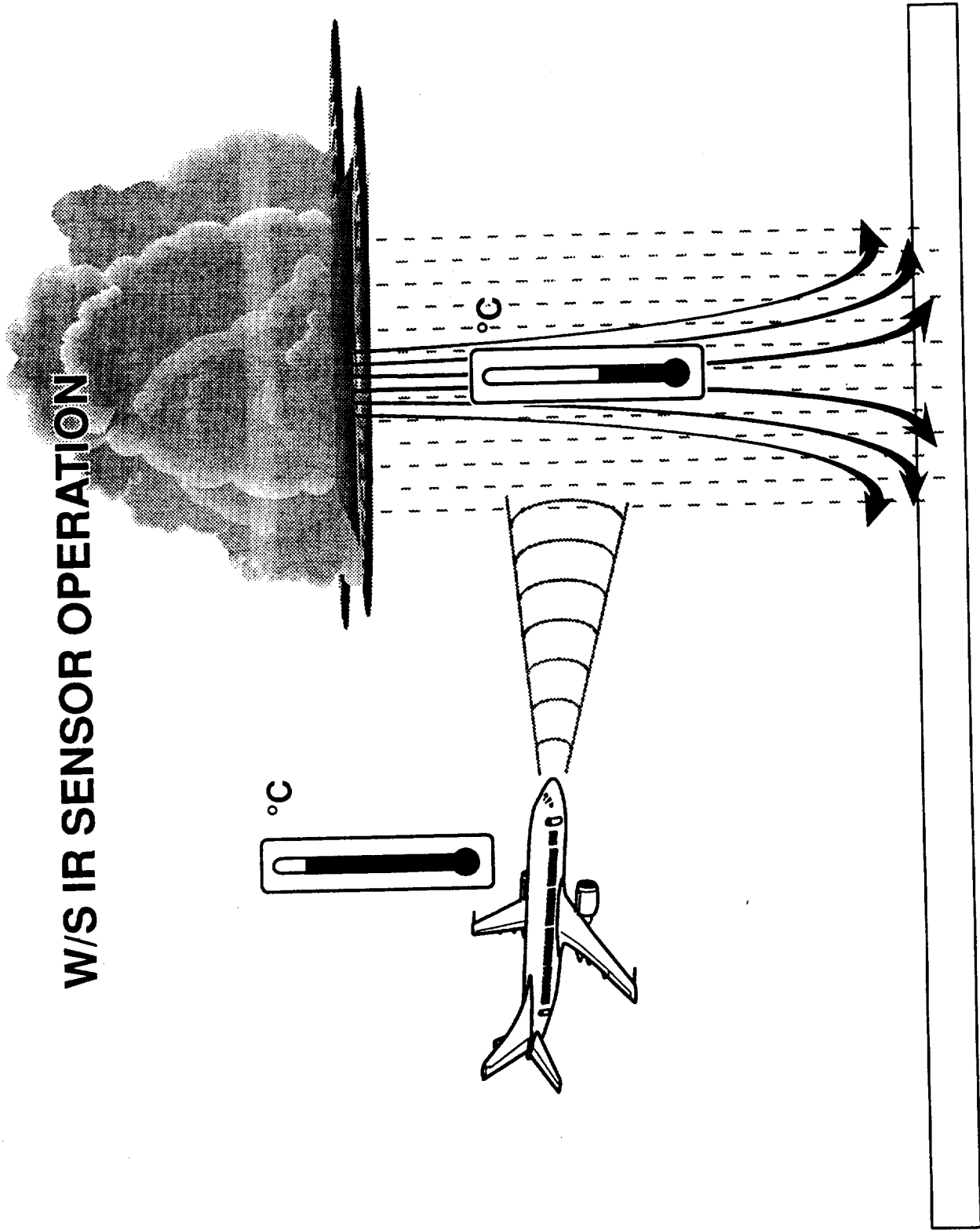
**RESEARCH AIRCRAFT
SENSOR INSTALLATIONS**



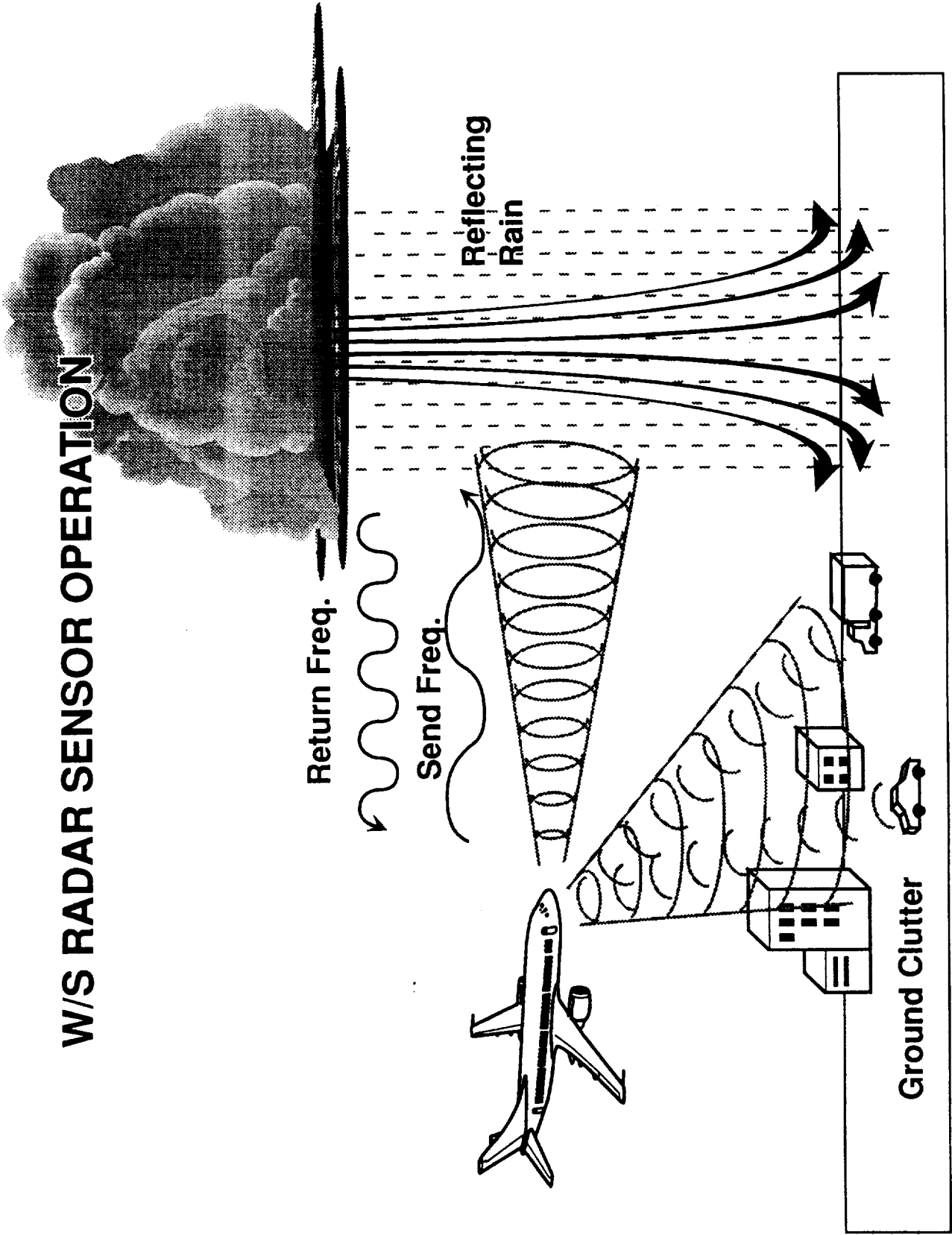
W/S REACTIVE SENSOR OPERATION



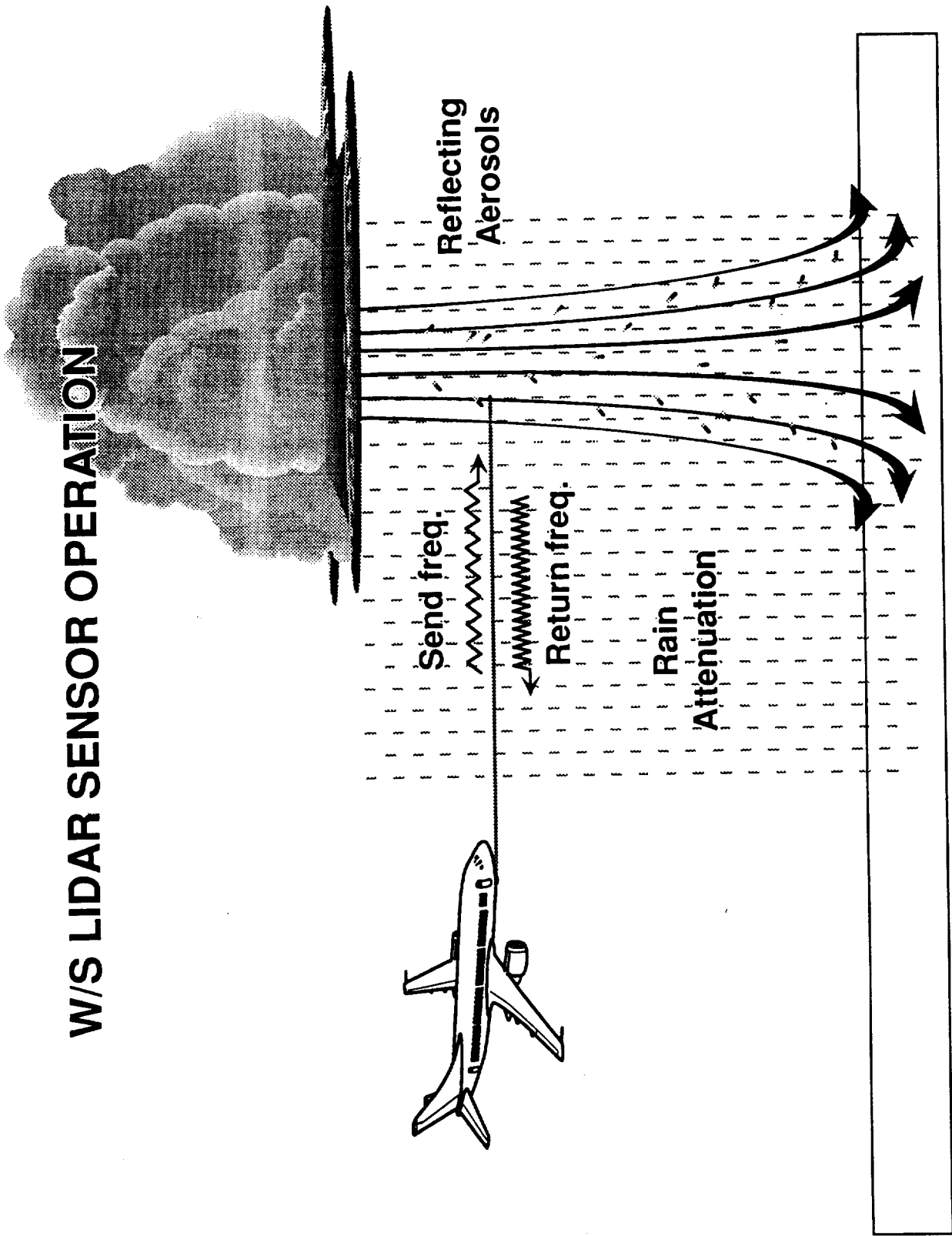
W/S IR SENSOR OPERATION



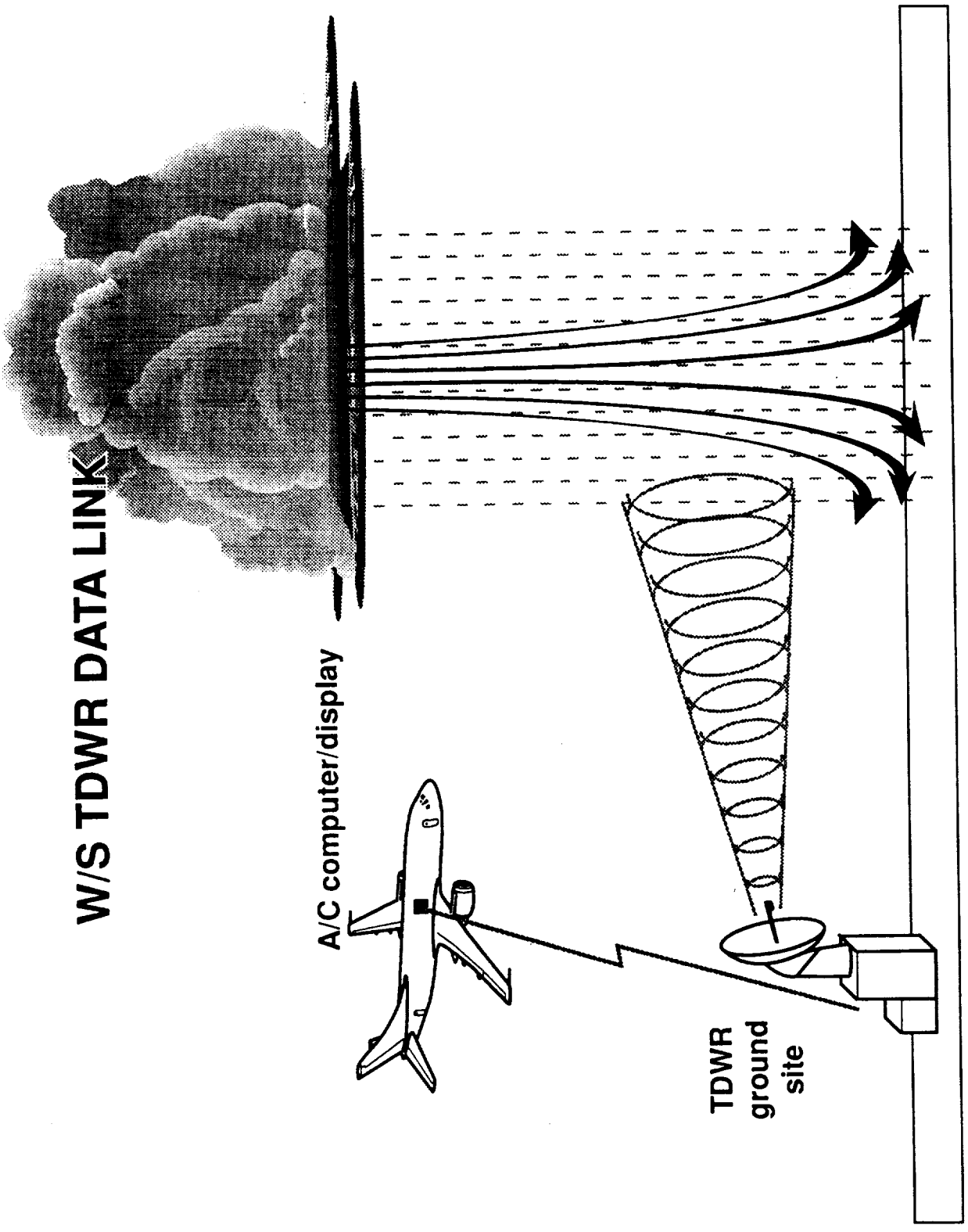
W/S RADAR SENSOR OPERATION



W/S LIDAR SENSOR OPERATION



W/S TDWR DATA LINK



WIND SHEAR AIRBORNE SENSORS PROGRAM

1991 FLIGHT TEST SUMMARY

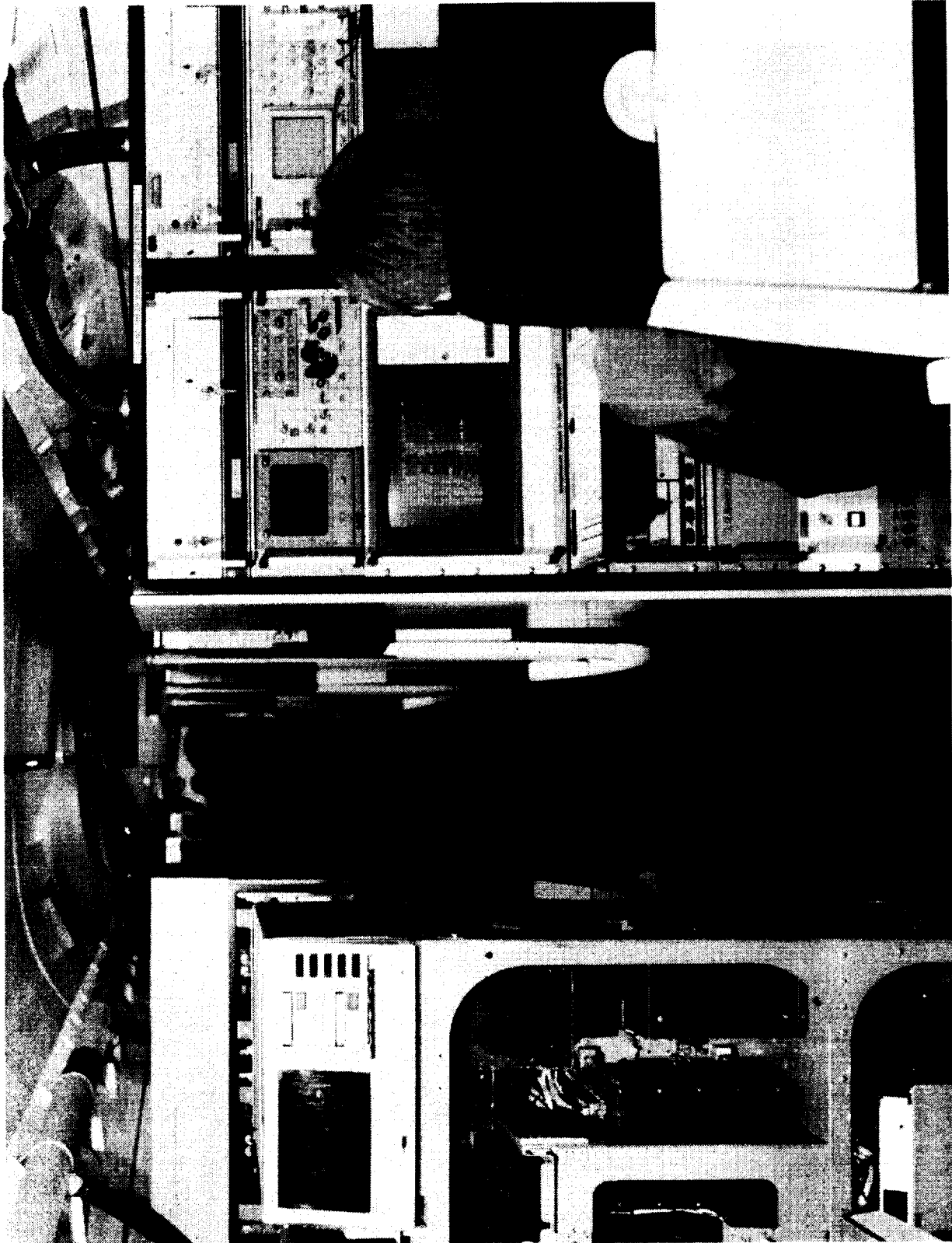
- **INSTRUMENT SYSTEM CHECKOUT (- 2/91)**
- **CLEAR WEATHER DATA FLIGHTS (2/91 -4/91)**
- **LOCAL IN/NEAR WEATHER FLIGHTS (5/91)**
- **DEPLOYMENT PREPARATION FLIGHTS (5/91)**
- **ORLANDO (6/91), DENVER (7/91) DEPLOYMENTS**
 - **FULL SAFETY, FLIGHT OPERATIONS REVIEWS**
 - **ATC, GROUND SITE, TDWR PREPARATIONS**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

WIND SHEAR AIRBORNE SENSORS PROGRAM

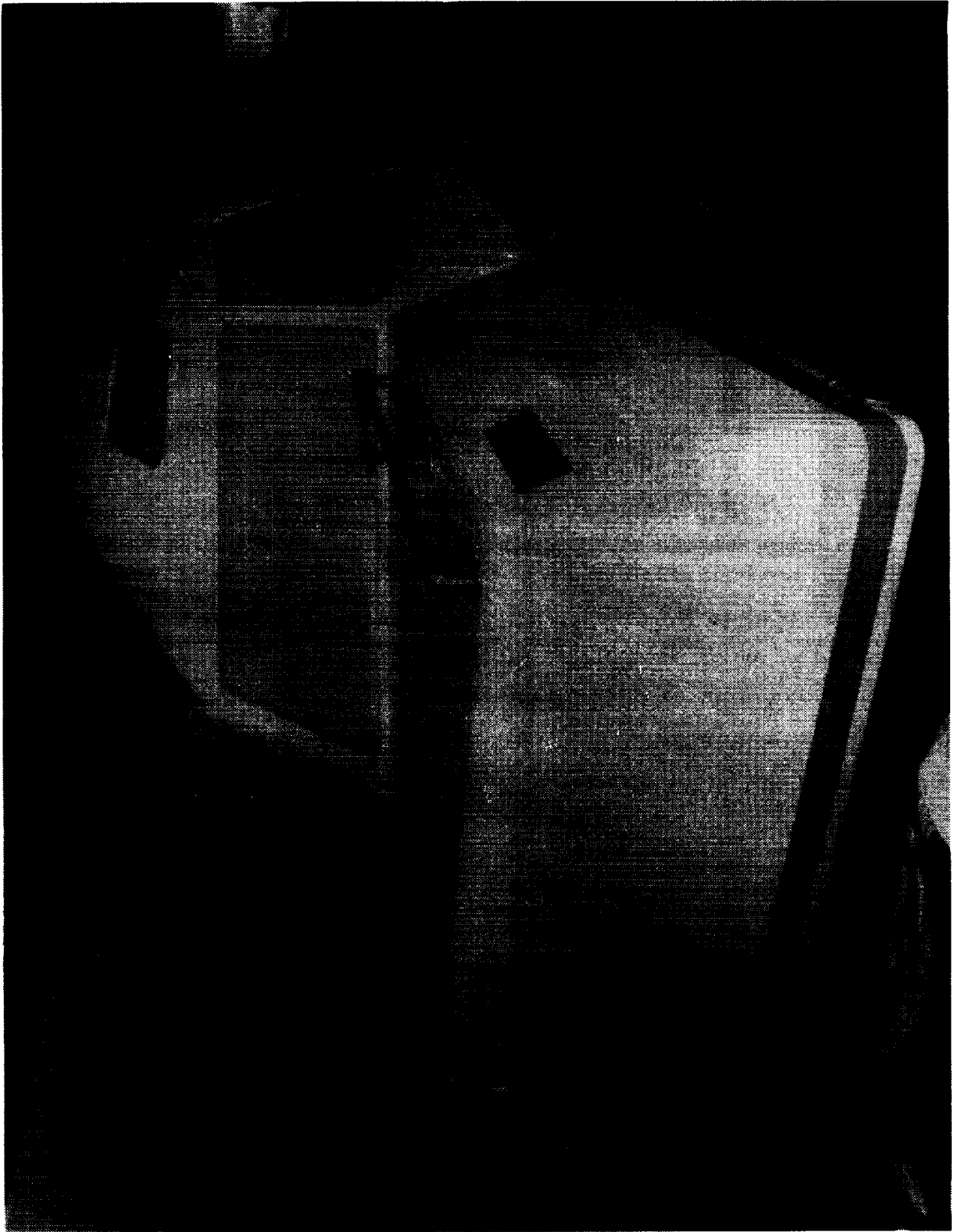
1991 DEPLOYMENT GOALS

- 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

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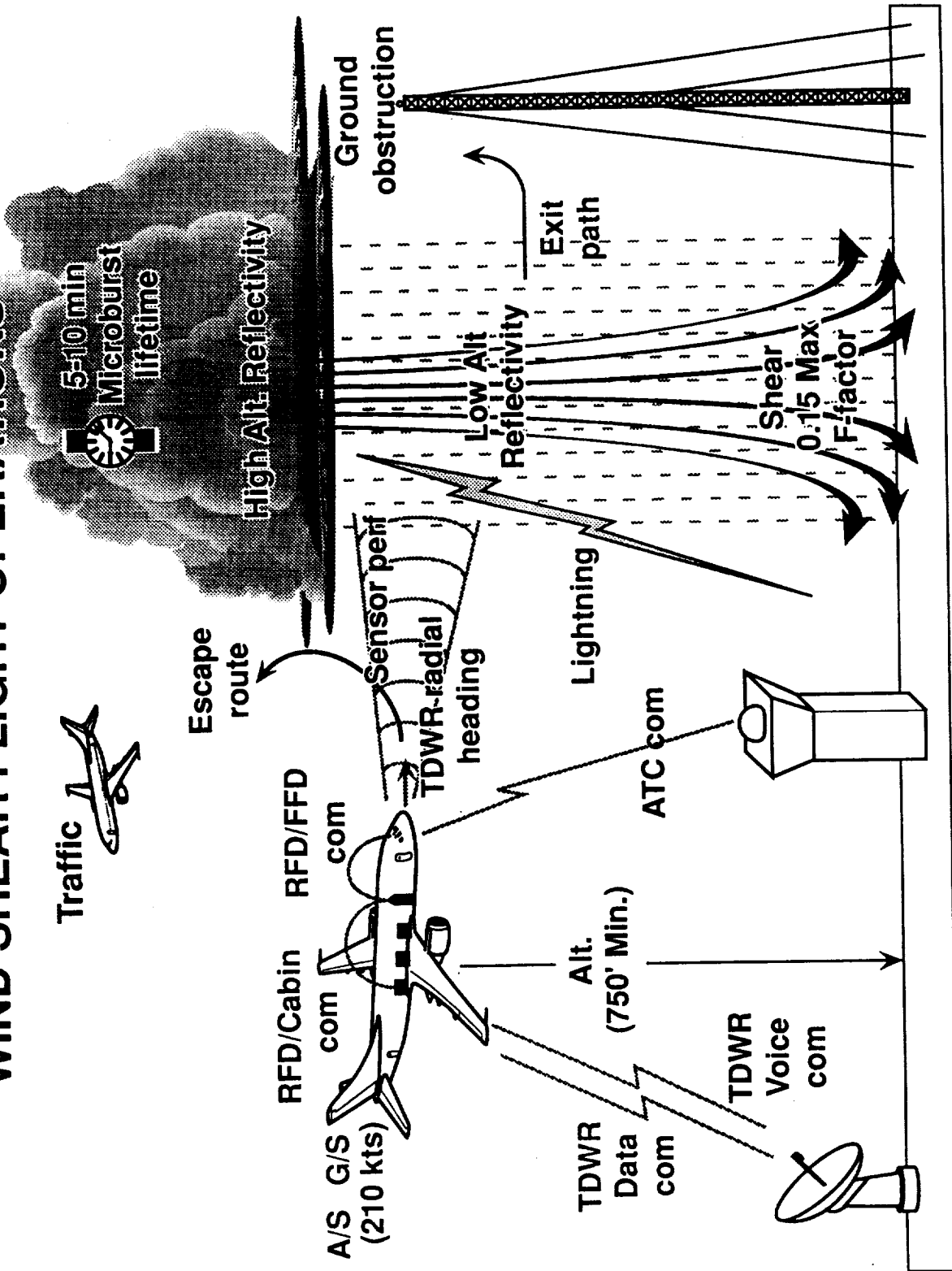
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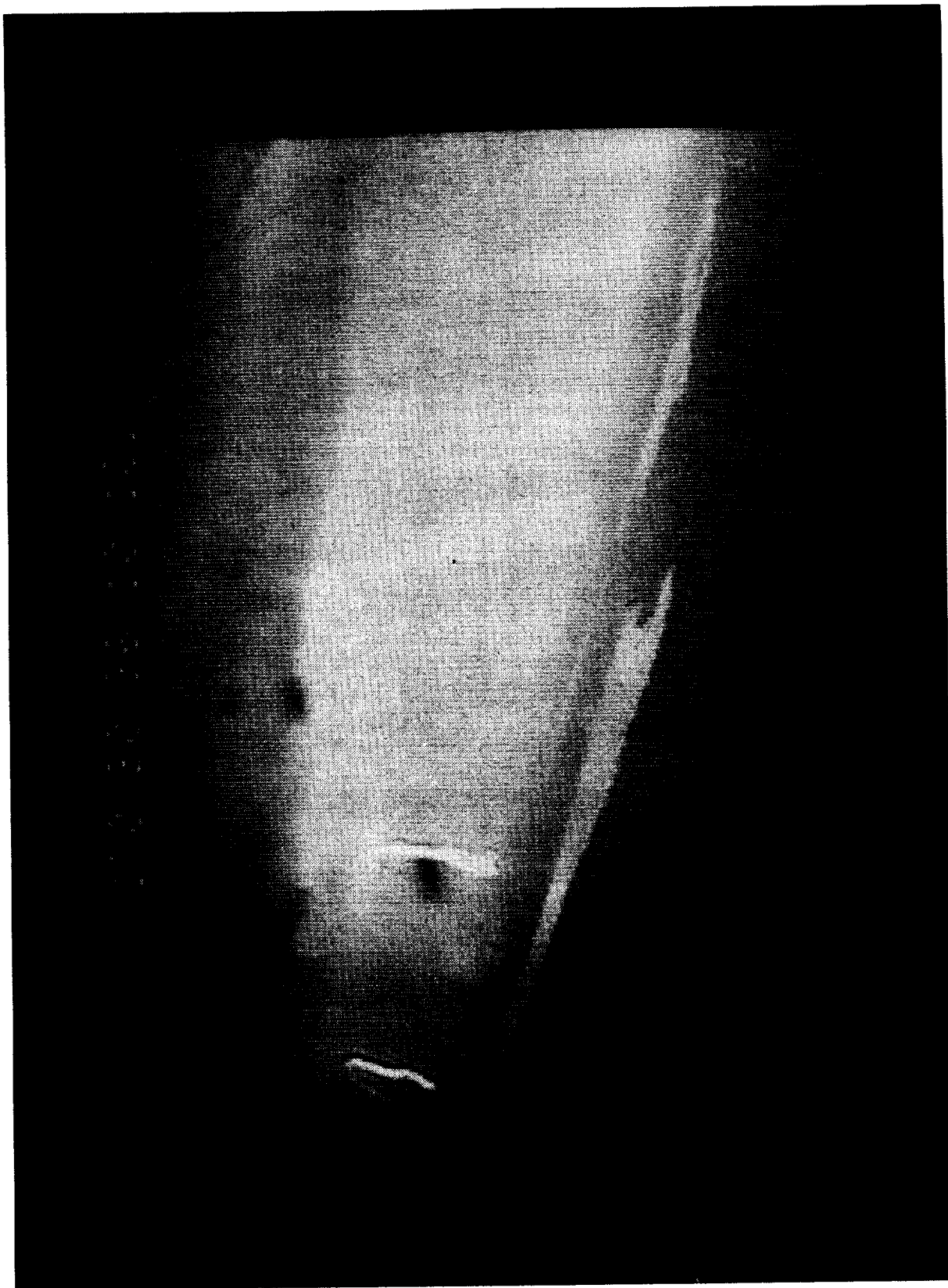


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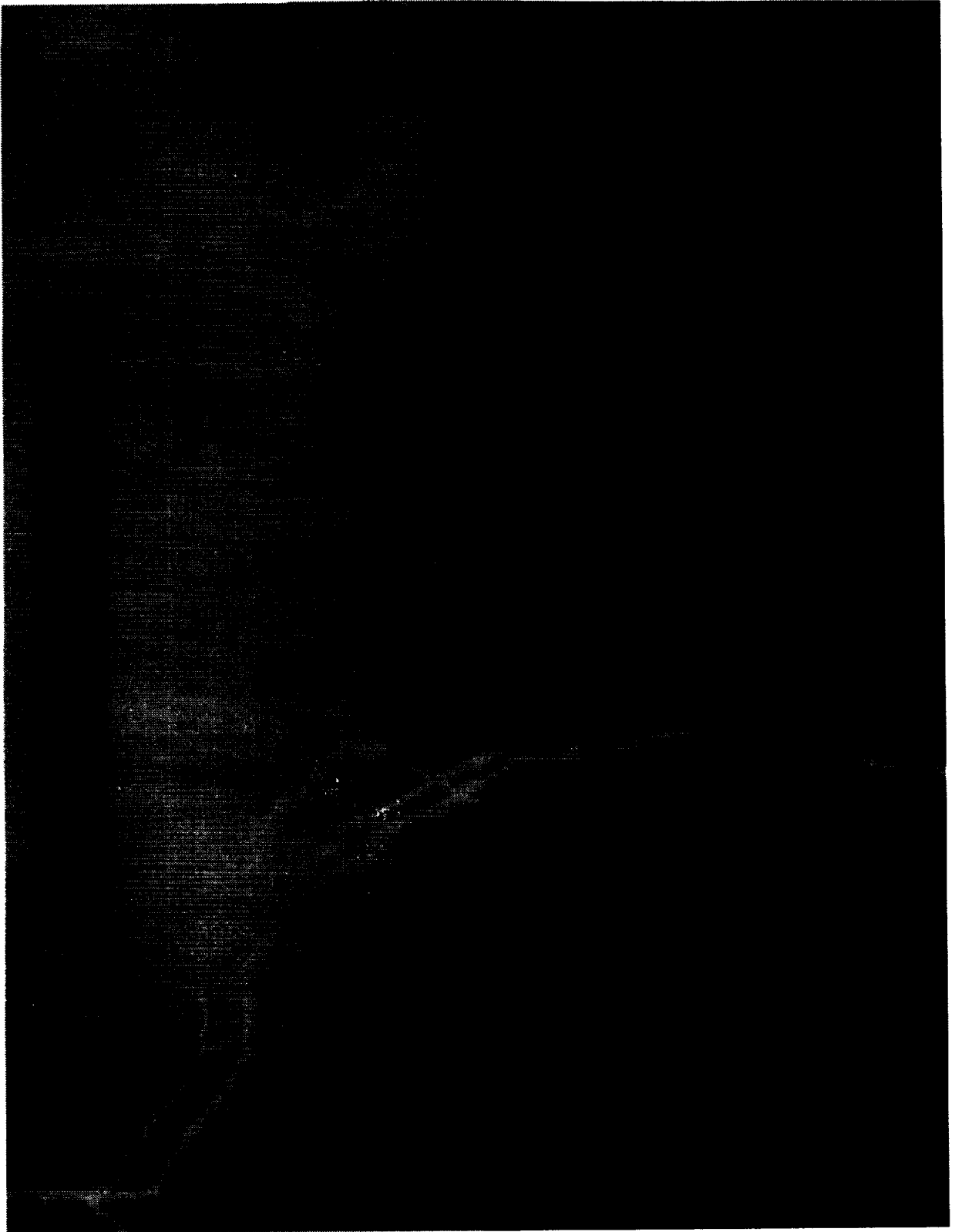


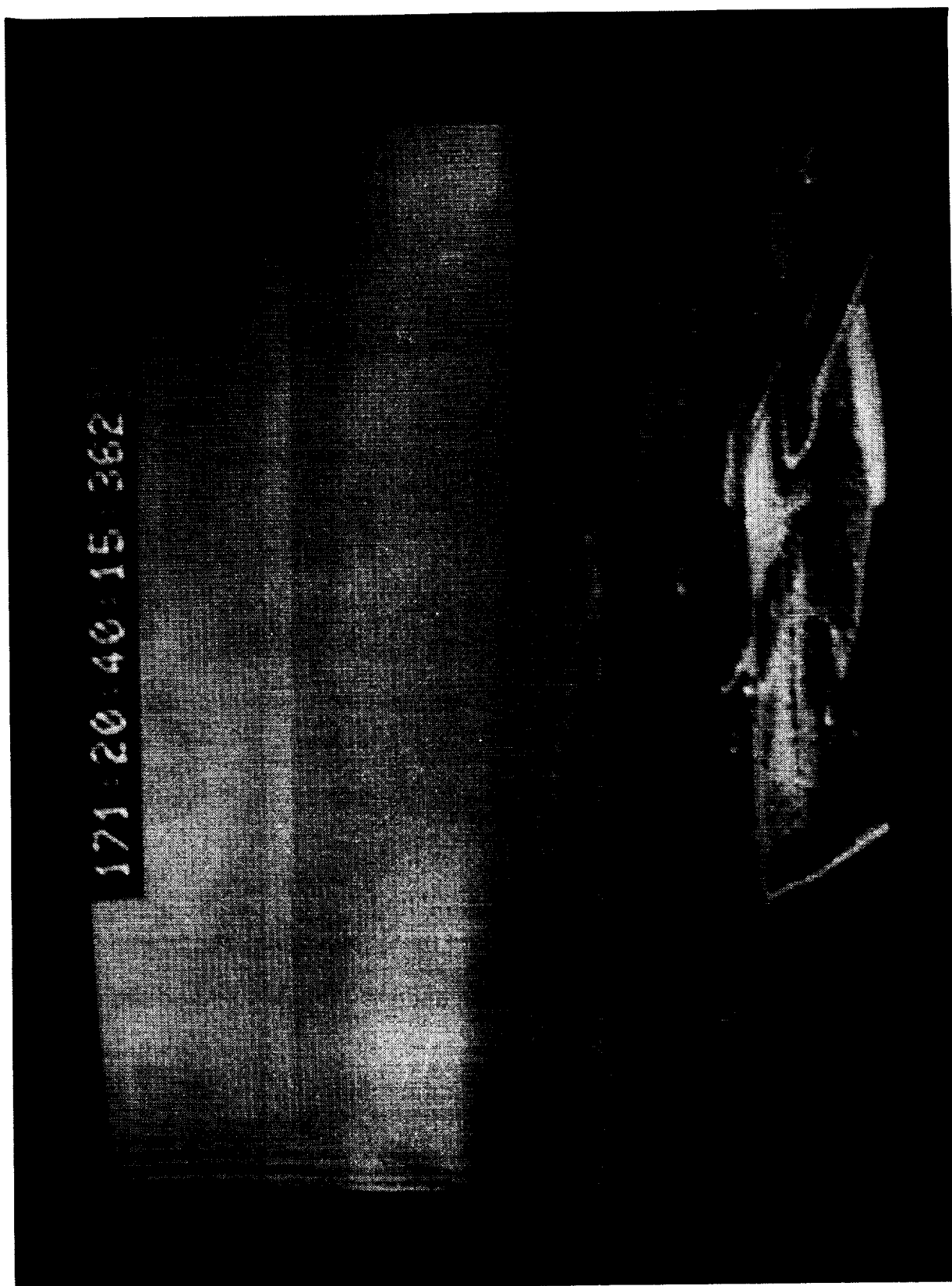
WIND SHEAR FLIGHT OPERATIONS





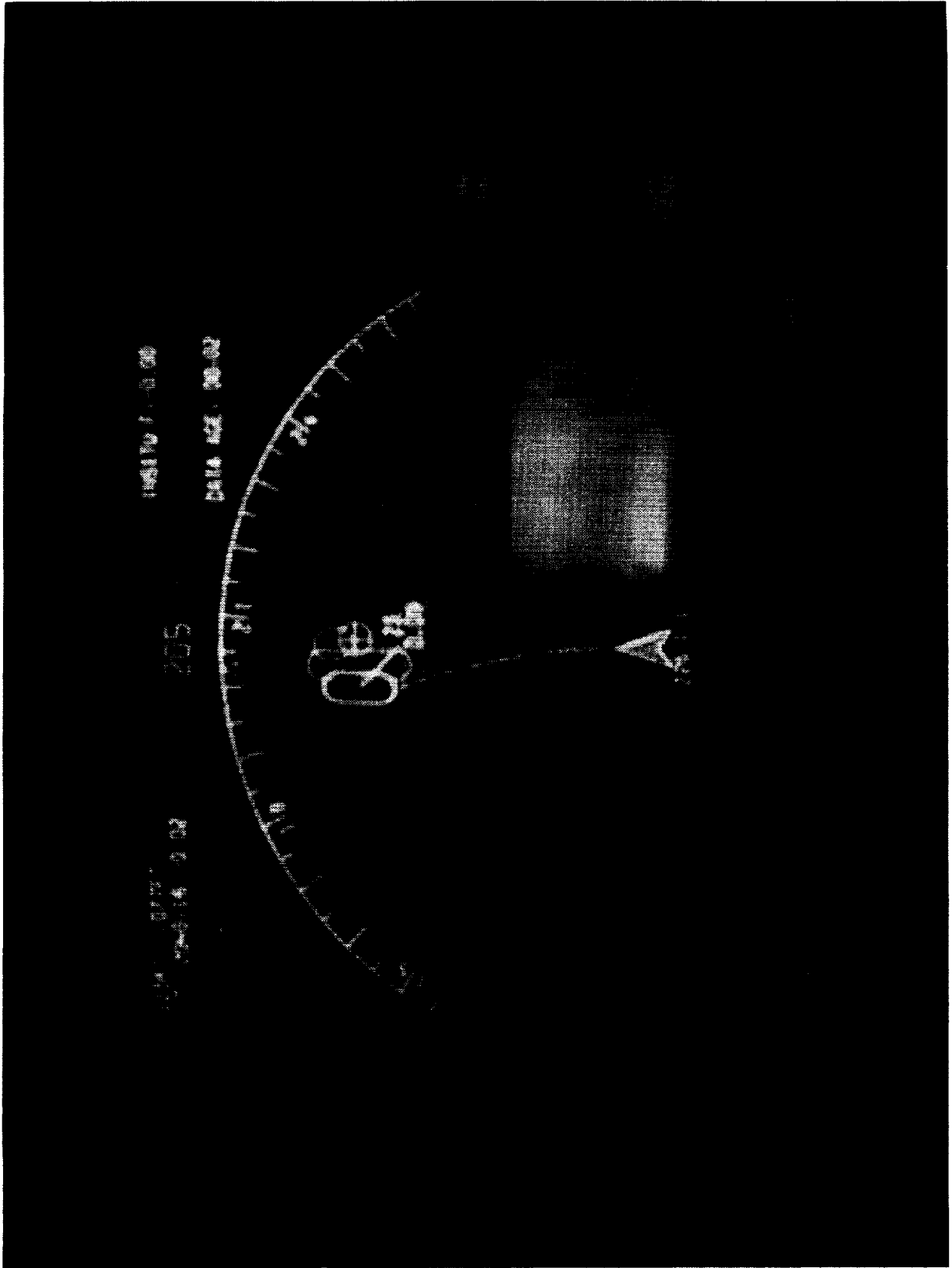
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WIND SHEAR AIRBORNE SENSORS PROGRAM

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 DEFINITELY 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

