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STATUS OF THE TERMINAL DOPPLER WEATHER RADAR WITH DEPLOYMENT UNDERWAY

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ABSTRACT

The Federal Aviation Administration (FAA) initiated the Terminal Doppler Weather Radar (TDWR) program in the mid-1980's in response to the need for improved real-time hazardous weather (especially low-altitude wind shear) surveillance in the terminal area [Turnbull, et al., 1989]. The initial focus of the TDWR was to provide reliable, fully automated Doppler radar detection of microbursts and gust fronts and 20-minute warning of wind shifts which could effect runway usage. Subsequent operational demonstrations have shown that the overall terminal situational awareness provided by the TDWR color Geographical Situation Display (GSD) depiction of wind shear locations, weather reflectivity and storm motion also yields substantial improvements in terminal operations efficiency for air traffic managers and for airlines. In this paper, we will describe the current status and deployment strategy for the operational systems and recent results from the extensive testing of the radar system concept and of the weather information dissemination approach.

Following the successful operational evaluation of the TDWR concept which was described at the last conference [Turnbull, et al., 1989], a production contract was awarded to the Raytheon Corporation [Weiler and Shrader, 1991] and the first deliveries occurred as scheduled in the fall of 1992. Figure 1 shows the 45 major airports receiving the TDWR, including the three systems delivered to the FAA as of 1 June 1993 and the six other systems to be delivered in 1993. An important element of the overall program success in meeting the ambitious schedule was the effective use of the Department of Defense 2167A methodology for software development [Jones, 1992].

All TDWR systems will be delivered by 1995. The TDWR systems are being installed at sites typically 8 to 12 miles from the major airports, with the locations selected based on careful site surveys, including experimental measurements of line-of-sight visibility (optically and at IR) as well as clutter (at X band) and RF interference (at C band) environment measurements using the system shown in figure 2.

Formal operational test and evaluation of the first TDWR production system was successfully carried out in Oklahoma City in the fall of 1992 and spring of 1993 [Vasiloff, et al., 1993a, Vasiloff, et al., 1993b]. Additional operational demonstrations have been carried out in Orlando[Evans, 1991] and Denver [Mahoney and Biter, 1993] using TDWR testbed systems to:

1. Further assess the performance of the wind shear detection algorithms and establish regional site adaptation parameters,
2. Assess the operational utility of new TDWR products currently being implemented by Raytheon such as integration of wind shear warnings from TDWR and LLWAS systems, and a storm motion product,
3. Determine the utility of TDWR-derived warnings provided directly to pilots via data link and the utility of the TDWR color GSD for improving airline airport operations, and

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4. Investigate the utility of the TDWR together with other FAA/NWS terminal sensors to provide capacity enhancement products such as 3D winds for use by terminal automation, improved runway management and wake vortex advisory systems.

This extensive testing program has reconfirmed both the safety benefits and the significant improvement that the TDWR can make to reducing delays by enhancing the capability for planning. For example, the testing in Orlando has demonstrated that, over time, supervisors and terminal planners learn to take advantage of the overall situational awareness provided by the GSD to adapt runway usage such that far fewer wind shear warnings need to be issued by the tower local controllers. Testing in Denver has shown that airport airline operations personnel can make substantial reductions in the cost associated with adverse weather by better anticipating the impact on their operations. The full paper will describe the FAA plans for distribution of TDWR products to airlines.

Additionally, key elements of the radar such as the ability to operate in heavy rain environments and cope with the range/velocity folding challenge at C-band were demonstrated in Orlando. The TDWR/LLWAS integration testing carried out using a rigorous runway wind component scoring methodology indicated that the TDWR alone provided microburst or wind shear alert warnings on 98% of the strong microburst events (wind shear >30 knots), with 1 % false alarms for a microburst alert warning [Cole and Todd, 1993]. Examples of the technical performance evaluation will be discussed in the full paper.

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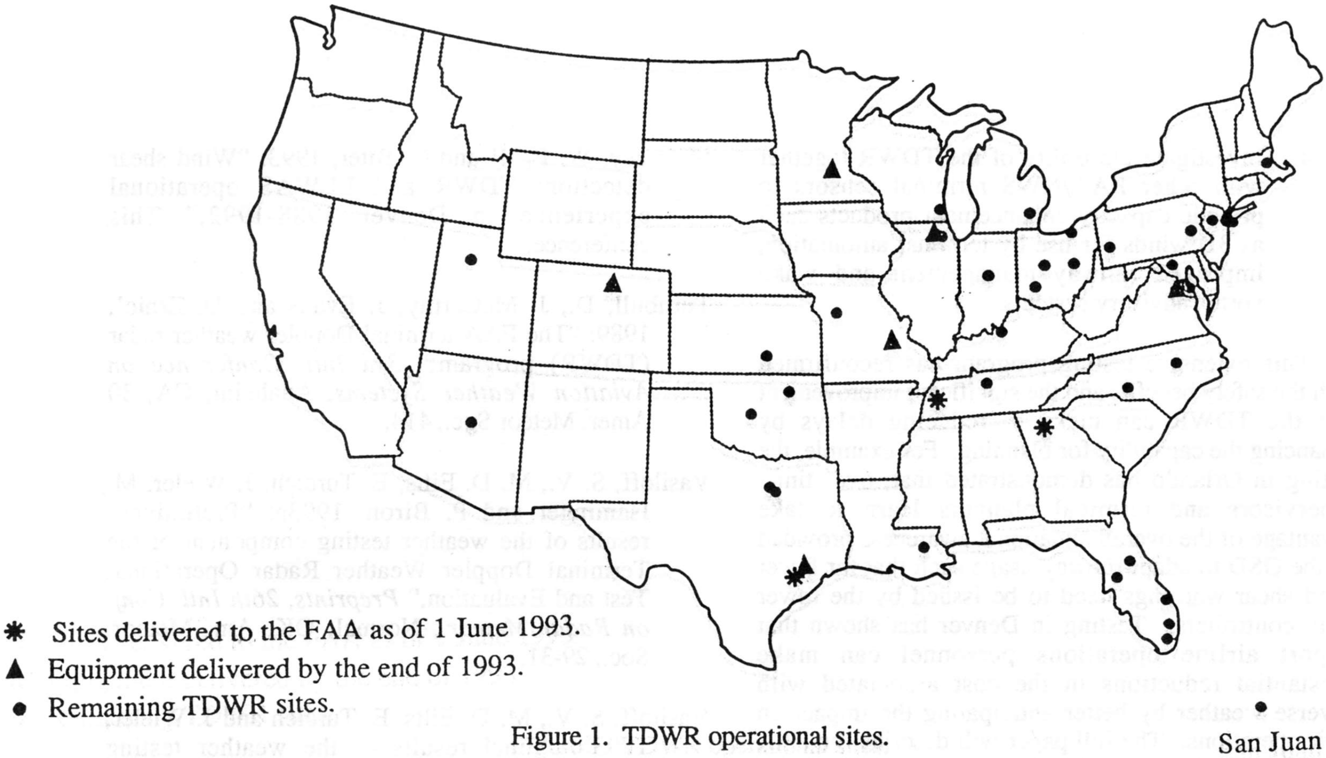
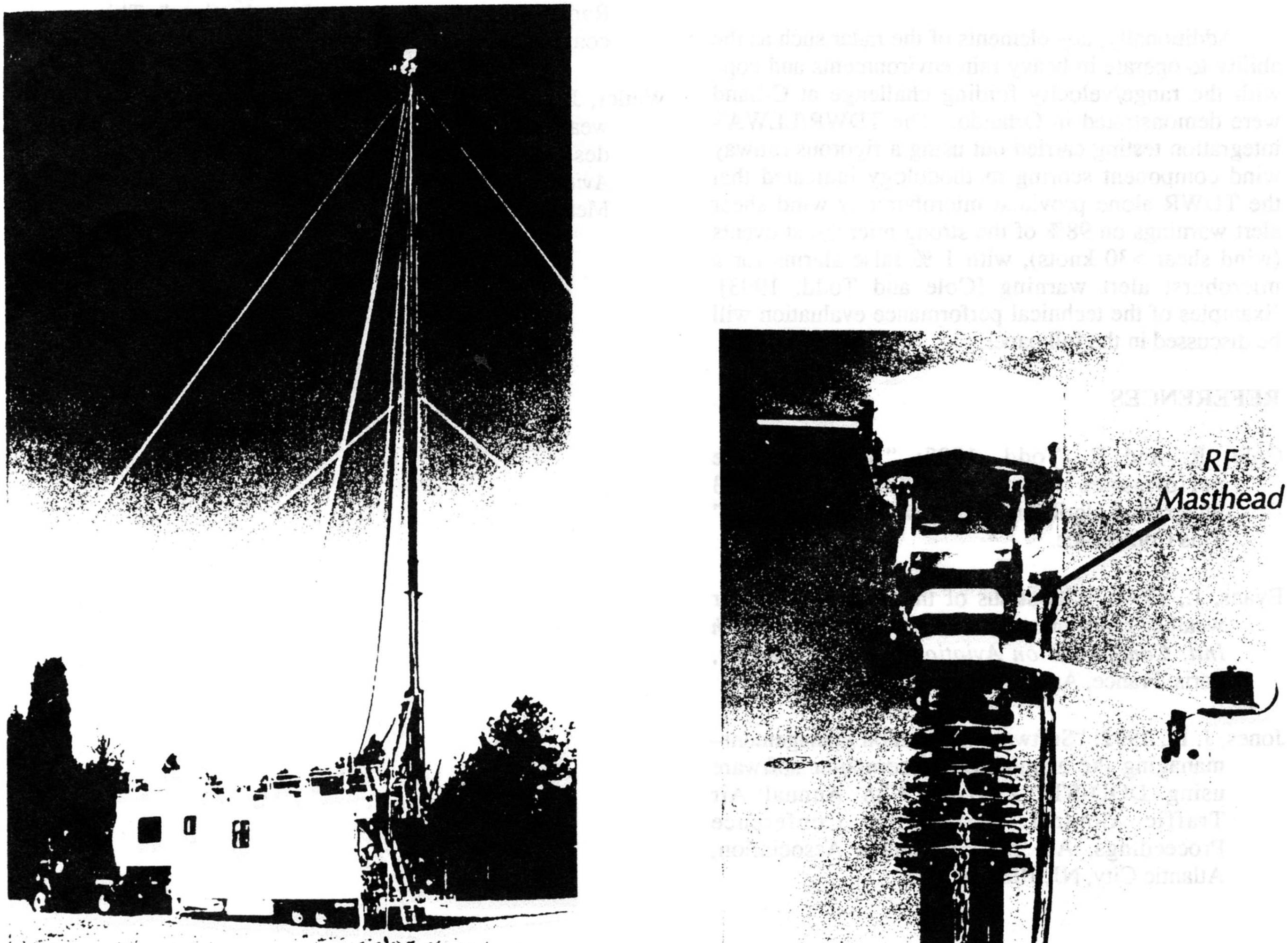


Figure 1. TDWR operational sites.



Measurement van in operational mode

Details of RF measurement masthead

Figure 2. TDWR site survey system.