

# **WIVIS Weather Identifier and Visibility Sensor**

## **Visibility Test Report**

Based on Tests Conducted at  
Sterling Test and Evaluation Branch  
National Weather Service

October 1997

### **1. INTRODUCTION**

This report describes the results of the testing of the visibility portion of the ScTI Weather Identifier and Visibility Sensor (WIVIS). The first test was conducted from late December 1993 to early February 1994. The second test was conducted from December 1996 to May 1997. The purpose of the tests was to validate the WIVIS visibility measurement against recognized NWS standards in different weather conditions. Data was presented which compare the WIVIS visibility to the average of ASOS approved standard visibility sensors. This report only addresses the WIVIS performance when the visibility was 7 miles or less.

### **2. TEST APPROACH**

The tests were conducted at the NWS Test and Evaluation Branch in Sterling Virginia. The sensors were installed in late December 1993. Tests were conducted in typical winter conditions of rain, snow, and fog events. The median values of visibility measurements from NWS standard visibility sensors were used to compare with the WIVIS results. The standard visibility sensors are a visible light (xenon) based forward scatter sensors. They have been tested extensively for more than 5 years at Sterling against 2 sets of transmissometer standards.

Sterling maintains several fully instrumented test beds for sensor test and comparison to recognized standards. For this test the sensors were not collocated. WIVIS sensors were located in the present weather test bed located west of building 16. The NWS standard visibility sensor used for comparison purposes was located in the visibility sensor test bed approximately 1000 feet (.2 mile) southwest of building 16. WIVIS was located in the present weather test bed because it was also being tested for performance against the NWS present weather standards (LEDWI). In addition to the horizontal separation, the sensors were also installed at different heights. The NWS standard visibility sensors were installed at ~4 meters high while the WIVIS was located ~2 meters high. These differences in siting are significant, especially because of the spatial and temporal nature of precipitation and fog. To help overcome these differences, data from both the WIVIS and NWS standard visibility sensors have been analyzed using a 10 minute running average.

### 3. TEST 1 RESULTS

#### 3.1 INDIVIDUAL EVENTS

A detailed analysis of four significant low visibility events were performed to better quantify WIVIS performance in poor weather conditions.

**EVENT - 1/13/94 00:00 TO 1/13/94 12:00**

Visibility range is between 4 miles and 0.04 miles (200 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 25 to 35 F for the period.

**EVENT - 1/13/94 12:00 TO 1/14/94 12:00**

Visibility range is between 8 miles and 0.075 miles (400 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 40 F for the period.

**EVENT - 1/25/94 17:00 TO 1/26/94 05:00**

Visibility range is between 7 miles and 0.15 miles (800 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 35 to 45 F for the period.

**EVENT - 1/28/94 14:00 TO 1/29/94 02:00**

Visibility range is between 10 miles and 0.1 miles (500 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 40 F for the period.

#### 3.2 SUMMARY OF EVENTS

During the test period there were four (4) significant low visibility events where the visibility was below 10 miles. Overall, the WIVIS performance was excellent with an average correlation coefficient 94.24% as shown in the table below:

TIME	VISIBILITY EVENT	WIVIS vs NWS CORR. COEFF.
01/13/94 00:00 - 01/13/94 12:00	Ice Fog	91.06%
01/13/94 12:00 - 01/14/94 12:00	Fog	94.03%
01/25/94 17:00 - 01/26/94 05:00	Light Snow	96.80%
01/28/94 14:00 - 01/29/94 02:00	Fog	95.05%

## **4. TEST 2 RESULTS**

### **4.1 INDIVIDUAL EVENTS**

A detailed analysis of the seventeen (17) visibility events were performed to better quantify WIVIS performance in different weather conditions.

#### **EVENT - 1/2/97 00:00 TO 1/2/97 12:00**

Visibility range is between 10 miles and 2 miles. The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 50 F for the period.

#### **EVENT - 1/4/97 22:00 TO 1/5/97 10:00**

Visibility range is between 10 miles and 0.15 miles (800 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 45 to 60 F for the period.

#### **EVENT - 1/9/97 05:00 TO 1/9/97 17:00**

Visibility range is between 10 miles and 0.3 miles (1600 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 25 to 35 F for the period.

#### **EVENT - 1/10/97 16:00 TO 1/11/97 04:00**

Visibility range is between 10 miles and 0.15 miles (800 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 25 to 40 F for the period.

#### **EVENT - 1/22/97 22:00 TO 1/23/97 10:00**

Visibility range is between 10 miles and 0.05 miles (250 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 15 to 55 F for the period.

#### **EVENT - 2/1/97 02:00 TO 2/1/97 14:00**

Visibility range is between 10 miles and 0.25 miles (1300 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 60 F for the period.

#### **EVENT - 2/4/97 12:00 TO 2/5/97 00:00**

Visibility range is between 10 miles and 0.4 miles (2000 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 35 to 40 F for the period.

#### **EVENT - 2/8/97 00:00 TO 2/9/97 00:00**

Visibility range is between 10 miles and 0.2 miles (1000 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 25 to 40 F for the period.

**EVENT - 2/14/97 20:00 TO 2/15/97 08:00**

Visibility range is between 10 miles and 0.2 miles (1000 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 20 to 40 F for the period.

**EVENT - 3/1/97 04:00 TO 3/1/97 16:00**

Visibility range is between 10 miles and 0.5 miles (2600 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 40 to 55 F for the period.

**EVENT - 3/3/97 22:00 TO 3/4/97 10:00**

Visibility range is between 7 miles and 1 mile. The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 35 to 40 F for the period.

**EVENT - 3/5/97 14:00 TO 3/6/97 02:00**

Visibility range is between 8 miles and 0.2 miles (1000 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 20 to 40 F for the period.

**EVENT - 3/14/97 14:00 TO 3/15/97 02:00**

Visibility range is between 10 miles and 0.9 miles (4500 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 40 to 50 F for the period.

**EVENT - 3/19/97 02:00 TO 3/19/97 14:00**

Visibility range is between 8 miles and 0.5 miles (2600 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 45 F for the period.

**EVENT - 4/21/97 22:00 TO 4/22/97 10:00**

Visibility range is between 10 miles and 0.08 miles (400 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 50 to 55 F for the period.

**EVENT - 4/23/97 20:00 TO 4/24/97 08:00**

Visibility range is between 10 miles and 3 miles. The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 40 to 50 F for the period.

**EVENT - 5/9/97 02:00 TO 5/9/97 14:00**

Visibility range is between 10 miles and 0.03 miles (150 feet). The scattering graph shows the visibility measured by WIVIS and NWS standard sensors are highly correlated. Temperatures were 30 to 65 F for the period.

## 4.2 SUMMARY OF EVENTS

During the test period there were seventeen (17) visibility events where the visibility was below 10 miles. Overall, the WIVIS performance was excellent with an average correlation coefficient 93.01% as shown in the table below:

TIME	VISIBILITY EVENT	WIVIS vs NWS CORR. COEFF.
01/02/97 00:00 - 01/02/97 12:00	Haze	93.73%
01/04/97 22:00 - 01/05/97 10:00	Fog	90.13%
01/09/97 05:00 - 01/09/97 17:00	Light Snow	86.96%
01/10/97 16:00 - 01/11/97 04:00	Snow	98.91%
01/22/97 22:00 - 01/23/97 10:00	Fog	88.00%
02/01/97 02:00 - 02/01/97 14:00	Fog	94.48%
02/04/97 12:00 - 02/05/97 00:00	Ice Pellet & Rain	96.28%
02/08/97 00:00 - 02/09/97 00:00	Snow	95.37%
02/14/97 20:00 - 02/15/97 08:00	Rain	92.62%
03/01/97 04:00 - 03/01/97 16:00	Rain	91.37%
03/03/97 22:00 - 03/04/97 10:00	Haze	95.73%
03/05/97 14:00 - 03/06/97 02:00	Rain & Fog	95.79%
03/14/97 14:00 - 03/15/97 02:00	Mist	91.91%
03/19/00 02:00 - 03/19/00 14:00	Rain & Snow	95.30%
04/21/97 22:00 - 04/22/97 10:00	Fog	91.90%
04/23/97 20:00 - 04/24/97 08:00	Drizzle	91.79%
05/09/97 02:00 - 05/09/97 14:00	Fog & Rain	91.00%

## **5. CONCLUSIONS**

As shown in the scattering graphs, the WIVIS and NWS standard are highly correlated and exhibit an almost perfect 1:1 slope. The minor data scatter observed in the summary chart below 0.2 miles would be further reduced by collocation of the WIVIS and NWS standard.