



GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
MICHIGAN AERONAUTICS COMMISSION
LANSING



Automated Weather Observation Station (AWOS) Task Force Final Report

Introduction

The Michigan Aeronautics Commission (MAC) and the Michigan Department of Transportation Office of Aeronautics (Aeronautics) is charged with preserving and promoting a safe and efficient statewide aviation system. To support that mission, the MAC has prioritized all weather accessibility across the Michigan Aviation System. With a robust and resilient network of weather stations and weather dissemination equipment, airports across the state can attract and retain airport users during times of inclement weather. With this increased accessibility, local municipalities can maintain and grow the over \$22 billion economic impact general aviation provides to Michigan annually. Since 1990, the MAC has supported this critical component of Michigan's aviation safety infrastructure. As of 2021, Aeronautics is maintaining 41 non-federal AWOS Stations, which supplement the 30 additional federally operated weather stations at commercial service airports.

In 2020, the MAC convened the AWOS Task Force to examine the long-term viability of the Michigan AWOS System as component availability decreases, experienced technicians are increasingly sought after, and available resources decline, yet the aviation community's reliance on non-federal AWOS systems continues to grow. During the AWOS Task Force's initial meetings, the following goals were established:

1. Reassess the practical impact and level of service provided by the state supported AWOS network in Michigan.
2. Examine future AWOS needs to continue providing pilots with real time aviation weather observations at airports for pre-flight planning and while airborne, to enhance the safety of flight operations.
3. Make recommendations to ensure ongoing maintenance and upgrades of the existing Michigan AWOS network.

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4. If required, advocate for the financial and policy support necessary to upgrade the existing Michigan AWOS network.

AWOS Component and System Overview

As weather reporting and dissemination technology evolved throughout the late 20th century, a variety of different AWOS units from multiple manufacturers entered the market. As resource constraints, needs, and justification were considered for AWOS deployment across the state, several different AWOS configurations were deployed and remain in use by not only the aeronautics community, but also law enforcement agencies, insurance companies, schools and universities, and media outlets across Michigan. While these systems are currently not standardized, each system contains primary components as described below.

Each Michigan AWOS includes certified sensors for measurements of wind speed and direction, barometric pressure, temperature, relative humidity (reported as dewpoint), visibility, present weather, and cloud ceilings. All 41 Michigan AWOS systems are AWOS IIIIP systems. In addition, several stations have been upgraded to support both a precipitation accumulation and thunderstorm sensor.

Ancillary equipment installed on all stations include VHF radios for local aerial voice broadcast output; Onsite battery powered Uninterruptable Power Supply (UPS) for commercial power interruptions; and UG wiring/UHF radios/terminal building computers for local AWOS weather display, long line dissemination via internet, and remote maintenance access.

The current state supported AWOS operating model includes Aeronautics staff technicians to oversee the operation of the AWOS network, including scheduled maintenance, unscheduled maintenance, scheduling of and conducting required inspections, and maintaining all required specialized calibrated tooling and spare parts repository to ensure the resiliency of the system.

In addition to the capital infrastructure associated with the AWOS network, a critical component of the AWOS system lies in the dissemination of the data into the national Weather Message Switching Center Replacement (WMSCR) system. WMSCR allows the information collected from Michigan's AWOS system to be deployed through a variety of national data dissemination methods to ensure all users including pilots, both those actively flying and those performing preflight preparations, are receiving current weather data for situational awareness. Aeronautics utilizes Mackinac Software Inc. to transfer local weather data at individual sites to WMSCR. Mackinac Software also:

1. Collects AWOS data within the airport's terminal building and visually display this data to pilots within the building and via the internet.
2. Ports collected AWOS data for long line dissemination through the Federal Aviation Administration's (FAA's) National Airspace Data Interchange Network (NADIN) to the WMSCR.
3. Analyzes output for missing/bad/stuck/outage data, alert via email and display via internet, a system wide map of the current and historical status of all AWOS statewide.
4. Provides for remote maintenance connectivity via internet for technicians to analyze and troubleshoot system problems (before site arrival) for possible repair and parts needs.
5. Hosts a secure website to securely access/lockout these functions.

Challenges Facing Current Network

For the past 30 years, the Michigan AWOS network has performed exceedingly well because of the dedication of local airport sponsors, Aeronautics staff, and the MAC for providing support to the network. However, recent changes in the AWOS manufacturing and support community have called into question the long-term sustainability of the existing Michigan network because of less market competition for component manufacturing and the elimination of technical support for older legacy systems that exist in Michigan.

Currently, Michigan's entire non-federal AWOS network is based on 1990's technology, and components for such legacy systems are hard to find, hard to repair, and are mostly no longer supported. Within our existing network, all sites have a combination of certified current and legacy components to maintain the functionality of the network.

Federal Support for Non-Federal AWOS Systems

Non-federal AWOS systems have been installed in many locations across the nation by forward thinking states and municipalities seeking to provide the highest levels of aviation safety within their communities when federal resources were not available or could not be utilized in certain circumstances.

Today, FAA Airport Improvement Program (AIP) funding is available to support AWOS installation under certain circumstances, however, upgrades of existing systems that have become obsolete generally are not eligible for federal AIP support.

Additionally, the FAA issued a Memorandum on October 29, 2009, which established policy that required all non-federal AWOS equipment connections to the WMSCR be from a certified and commissioned AWOS-III or better, and the equipment must be certified in accordance with Advisory Circular 150/5220-16. The data from an AWOS-II

(or lower), could not be disseminated to WMSCR. This policy drives Michigan's decision to maintain a robust network of AWOS III or higher systems to ensure Michigan's weather data is available to system users across the country.

Analysis of AWOS System Longevity and Needs

As of August 2021, 21 of AWOS systems in Michigan (51%) are operating beyond their expected useful life. Within five years, the number of AWOS units operating beyond their useful life rises to 32 or 78%. By 2031, every AWOS unit in Michigan would be operating beyond its useful life. This quickly rising end of life limit, coupled with ongoing parts, staffing, and training issues discussed earlier, highlights the importance of establishing a strategy to maintain this important service to the Michigan aviation community.

Several strategies could be employed to address the end-of-life issues for Michigan's AWOS system including:

1. Complete replacement of the AWOS network by third party vendor – In this scenario, MDOT would contract with a third-party provider to remove all outdated AWOS systems, install new AWOS systems, and would require the vendor to provide all labor. This scenario is projected to cost approximately \$4,100,000 - \$6,200,000.
2. Phased replacement of AWOS network utilizing existing MDOT staff – In this scenario, MDOT would procure the necessary parts and equipment to accomplish the systemwide upgrade of the AWOS network and would phase deployment over the course of four years. This phased approach will allow MDOT to continue to support legacy systems over the course of the next four years with the inventory of parts that exists currently, while also beginning to deploy replacement systems. This scenario is projected to cost approximately \$3,900,000.

MAC AWOS Task Group Determinations and Recommendations

After careful evaluation of the current state of the Michigan AWOS system, the MAC AWOS Task Group makes the following determinations and recommendations:

1. The state maintained AWOS network, in conjunction with the federally supported AWOS/ASOS network, continue to provide unparalleled safety benefits to the aviation community in Michigan. With a greater than 99% reliability rate, the 41 non-federal AWOS stations in Michigan allow safe and efficient access to all areas of Michigan, many of which would experience tangible declines in services

offered to the public and reduced economic impact without the benefit of the Michigan AWOS network.

2. The AWOS Task Force recommends the MAC support ongoing efforts of MDOT Aeronautics to educate, retain, and preserve the dedicated staff needed to maintain the Michigan AWOS network.
3. Considering aging AWOS infrastructure and limited replacement components for the majority of existing AWOS systems, the AWOS Task Force recommends the MAC request the Michigan Legislature consider a one-time, multi-year appropriation of \$4 million to support a phased upgrade of existing AWOS systems over the next five years.

Appendix 1 - Chronology

- 1990 - Aeronautics began a state-local program for the purchase and installation of AWOS-IIIP to enhance safety and efficiency of the Michigan Aviation System.
- 1991 - The first non-federal AWOS in Michigan was installed in 1991 at Mackinac Island. This system was a Model V-B manufactured by Artais Weather Check, Inc.
- 1993 - Aeronautics entered in a contract with Pan Am Weather Systems for the purchase and installation of three AWOS. Pan Am subcontracted those systems to Handar, Inc., resulting in Handar systems being installed at Cadillac, Howell, and Port Huron. Maintenance of the systems at all four locations was conducted by Aeronautics technicians under a cost sharing arrangement with the airport sponsor.
- 1995 - Aeronautics established the Artais AWOS as the standard system for non-federal systems in Michigan, which resulted in the purchase and installation of 10 Artais systems.
- 1996 - Artais merged with Vaisala, Inc., which is headquartered in Helsinki, Finland. All subsequent purchases since that year, including the replacements of the three Handar systems, have been systems manufactured by Vaisala. An additional five systems were purchased and installed.
- 1999 – Vaisala unveils new V-C and V-D models. Utilizing only state funding, 13 AWOS were installed.
- 2004 – As state resources for AWOS installations declined, 10 AWOS were installed using FAA AIP resources.
- 2007 – With 38 Vaisala AWOS systems active in the state, Vaisala indicated all existing Model V-B, which included 15 AWOS systems in Michigan, had reached the end of their useful life and any component support would cease by 2008. This end-of-life (EOL) announcement ended support for 16 of the 38 AWOS systems in the state.
- 2010-2016 - Utilizing a variety of funding sources, 16 unsupported AWOS stations were upgraded. Additional purchase and installation of four AWOS was made.
- 2014 – Vaisala issued end-of-life notice for CT25K ceilometer and Park Air Model 4004 VHF Transmitter
- 2016 – Vaisala's United States AWOS Program is purchased by DBT Transportation. Along with this change, Vaisala ended production of the V-C and V-D model AWOS. DBT ramped up production of their newly certified AW20 model (an IP based system). Numerous EOL's were issued for older sensors including legacy barometers, temperature and relative humidity, ultrasonic wind, visibility, present weather, thunderstorm, ceilometer sensors, and UHF datalink radios.

- 2020 – Aeronautics' recent review of current spare stockpiles revealed a need for a longer-term strategy in maintaining current AWOS levels cost efficiently.

	Year Install / upgrade	Barometer	Ceilometer	Cell Modem	Display	Temp Sensor	Tipping Bucket	Wind Sensor	Xmtr	VC/VD	Upgrade Priority
Alma	1995/2011	PTB330	CL31A	Yes	Wthr Nex	HMP 45A		WS425	Park Air		4
Bad Axe	1996/2010	PTB330	CL31A		Wthr Nex	HMP 45A		WS425	Val 760		4
Beaver Island	2001	blue	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		1a
Bellaire	1995/2010	PTB330	CL31A		Wthr Nex	HMP 45A		WS425	Park Air		4
Big Rapids	1997/2010	PTB330	CL31A		Wthr Nex	HMP 45A	TR-525I-HT	WS425	Park Air		4
Cadillac	2000	PTB330	CL31A		Wthr Nex	HMP 155		mechanical	AWOS2000		1b
Caro	2004	PTB220	CT25K		Wthr Nex	HMP 155		mechanical	Val 760		2
Charlevoix	2001	blue	CT25K		Wthr Nex	HMP155		mechanical	Park Air		1a
Charlotte	2001	blue	CL31A		Wthr Nex	HMP 45A	TR-525I-HT	mechanical	Val 760		1a
Cheboygan	2001	blue	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		1a
Coldwater	1996/2011	PTB330	CL31A		Wthr Nex	HMP 45A		WMT702	Park Air		4
Drummond Island	2005	PTB220	CT25K		Wthr Nex	HMP 45D	TR525HT	mechanical	Val 760		2
Frankfort	2004	PTB220	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		2
Fremont	2007	PTB220	CL31	Yes	Wthr Nex	HMP155		WS425	AWOS2000		3
Grosse Ile	1995/2016	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WMT702	AWOS2000	Split	4
Harbor Springs	2001	blue	CT25K		Wthr Nex	HMP 155		mechanical	Val 760		1a
Hillsdale	1997/2016	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WS425	AWOS2000		4
Howell	2005	PTB220	CL31A		Wthr Nex	HMP 45D	TR-525I-HT	mechanical	Val 760		2
Ionia	2009	PTB330	CL31		Wthr Nex	HMP 45A	TR-525I-HT	WS425, rem	Val 760		3
Lambertville	2001	blue	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		1a
Lapeer	2012	PTB330	CL31A		Wthr Nex	HMP 45A	TR-525I-HT	WS425	Val 760		4
Ludington	1999	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	mechanical	AWOS2000		1b
Mackinac Island	1990/2010	PTB330	CL31A		Wthr Nex	HMP 45A	TI-525-HT	WS425, rem	Park Air		4
Manistique	1997/2013	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WMT702	AWOS2000		4
Marquette	2000	PTB330	CL31A	Tstorm	Av/Av/Wn	HMP 45A	TR-525I-HT	mechanical	AWOS2000	ACU/UHF	1b
Marshall	1996/2013	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WMT702	Park Air		4
Mason	1995/2010	PTB330	CL31A		Wthr Nex	HMP155		WS425	Val 760		4
Midland	2008	PTB220	CL31		Wthr Nex	HMP 45A	TR-525I-HT	WS425	AWOS2000		3
Monroe	1995/2015	PTB330	CL31A	Yes	Wthr Nex	HMP 155	TR-525I-HT	WS425	AWOS2000	Split	4
Mt Pleasant	1999	blue	CT25K		Wthr Nex	HMP 45A	TR-525-HT	mechanical	AWOS2000		1a
Newberry	1996/2013	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WS425	AWOS2000		4
Oscoda	1994/2011	PTB330	CL31A		Wthr Nex	HMP 45A	TR-525I-HT	WMT702	Val 760	Split	4
Owosso	2004	PTB220	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		2
Port Huron	2001	blue	CL31A		Wthr Nex	HMP 45A		mechanical	Park Air		1a
Rogers City	2004	PTB220	CL31A		Wthr Nex	HMP 45A		mechanical	Val 760		2
Saginaw	2000	blue	CT25K		Wthr Nex	HMP 45A		mechanical	Park Air		1a
South Haven	2004	PTB220	CT25K		Wthr Nex	HMP155		mechanical	Val 760		2
Sturgis	1995/2015	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	WMT702	AWOS2000		4
Three Rivers	2005	PTB220	CT25K		Wthr Nex	HMP 45A		mechanical	Val 760		2
Troy	2004	PTB220	CT25K		Wthr Nex	HMP 45A		mech, rem	Val 760		2
West Branch	2016	PTB330	CL31A		Wthr Nex	HMP 155	TR-525I-HT	ultrasonic	AWOS2000		4

File at: Etronics/AWOS/On-Site Equipment Inventory.xlsx

* all sites have FD12P currently

1a-	9
1b	3
2	9
3	3
4	17
total	41

AWOS Replacement Items & Schedule

	Upgrade Needs	Projected Year	Completion Date	Funding Means
Alma	Park Air			
Bad Axe	none	-----	-----	-----
Beaver Island	CT25K			
Bellaire	Park Air			
Big Rapids	Park Air			
Cadillac	CT25K & Park Air	2018		state/local
Caro	CT25K			
Charlevoix	CT25K & Park Air			
Charlotte	CT25K	2017	4/18/2017	state/local
Cheboygan	CT25K	2018		state/local
Coldwater	Park Air			
Drummond Island	CT25K			
Frankfort	CT25K			
Fremont	none	-----	-----	-----
Grayling	CT25K			
Grosse Ile	VB system	2016	6/28/2016	state/local
Harbor Springs	CT25K	2017		state/local
Hillsdale	VB system	2016	7/28/2016	state/local
Howell	CT25K	2016	10/4/2016	state/local
Ionia	none	-----	-----	-----
Lambertville	CT25K			
Lapeer	none	-----	-----	-----
Ludington	CT25K & Park Air	2016	7/28/2016	state/local
Mackinac Island	Park Air			
Manistique	none	-----	-----	-----
Marquette	CT25K & Park Air	2017		state/local
Marshall	Park Air			
Mason	none	-----	-----	-----
Midland	none	-----	-----	-----
Monroe	none	-----	-----	-----
Mt Pleasant	CT25K	2018		state/local
Newberry	none	-----	-----	-----
Oscoda	none	-----	-----	-----
Owosso	CT25K			
Port Huron	Park Air			
Rogers City	CT25K	2016	8/17/2016	state/local
Saginaw	CT25K & Park Air			
South Haven	CT25K			
Sturgis	none	-----	-----	-----
Three Rivers	CT25K			
Troy	CT25K			
West Branch	none	-----	-----	-----

CT25K = ceilometer

Park Air = VHF transmitter

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Etronics/AWOS/On-Site Equipment Inventory.xlsx

as of: 8/17/2021

AIRPORT	ID	Original Install/Upgrade	Make/Model	End of Useful Life	Sensor/ Peripheral Needs	Upgrade Cost	Upgrade Labor Cost	Travel Costs	Ancillary Cost	TOTAL UPGRADE	Replace Cost - Vaisala by MDOT	Replace Cost - Vaisala contract	Replace Cost - All Weather INC	Notes	Recommend Upgrade/Replacement
Mackinac Island	MCD	1989/2010	VB / VC	2025	T/DP, radio, UPS, ultra winds, Viz	34,200.00	3,190.00	2,000.00	2100	41,490.00	94,400	104,400	151,000		
Oscoda	OCS	1994/2011	VB Split / VD	2026	T/DP, radio, UPS, Viz, Tip Bkt	29,700.00	2,300.00	1,500.00	2100	35,600.00	95,000	105,000	151,000		
Alma	AMN	1995/2011	VB / VC	2026	T/DP, radio, UPS, ultra winds, Viz, Tip Bkt	35,400.00	3,520.00	500.00	2100	41,520.00	94,400	104,400	151,000		split/UHF
Bellaire	ACB	1995/2010	VB / VC	2025	T/DP, radio, UPS, ultra winds, Viz, Tip Bkt	35,400.00	3,520.00	1,500.00	2100	42,520.00	94,400	104,400	151,000		
Grosse Ile	ONZ	1995/2016	VB Split / VD	2031	UPS, Viz	21,500.00	1,430.00	1,000.00	2100	26,030.00	95,000	105,000	151,000		split/UHF
Mason	TEW	1995/2010	VB / VC	2026	radio, UPS, ultra winds, Viz, Tip Bkt	32,900.00	3,190.00	500.00	2100	38,690.00	94,400	104,400	151,000		
Monroe	TTF	1995/2015	VB / VD	2030	ultra winds, UPS, Viz	28,500.00	2,530.00	1,000.00	2100	34,130.00	95,000	105,000	151,000		split/UHF, site leans
Sturgis	IRS	1995/2015	VB / VC	2030	UPS, Viz	21,500.00	1,430.00	1,000.00	2100	26,030.00	91,600	101,600	151,000		
Bad Axe	BAX	1996/2010	VB / VC	2026	T/DP, radio, UPS, ultra winds, Viz, Tip Bkt	35,400.00	3,520.00	1,500.00	2100	42,520.00	94,400	104,400	151,000		
Coldwater	OEB	1996/2011	VB / VC	2026	T/DP, radio, UPS, Viz, Tip Bkt	29,700.00	2,300.00	500.00	2100	34,600.00	91,600	101,600	151,000		
Marshall	RMV	1996/2013	VB / VC	2028	radio, UPS, Viz	24,700.00	1,760.00	500.00	2100	29,060.00	91,600	101,600	151,000		
Newberry	ERY	1996/2013	VB / VC	2028	ultra winds, UPS, Viz	28,500.00	2,530.00	2,500.00	2100	35,630.00	94,400	104,400	151,000		
Big Rapids	RGB	1997/2010	VB / VC	2031	T/DP, radio, UPS, ultra winds, Viz	34,200.00	3,190.00	1,000.00	2100	40,490.00	94,400	104,400	151,000		twr leans, relocated in 2012
Hillsdale	JYM	1997/2016	VB / VC	2031	ultra winds, UPS, Viz	28,500.00	2,530.00	5,000.00	2100	38,130.00	94,400	104,400	151,000		
Manistique	ISQ	1997/2013	VB / VC	2028	UPS, Viz	21,500.00	1,430.00	2,500.00	2100	27,530.00	91,600	101,600	151,000		
Ludington	LDM	1999	VC	2014	ultra winds, UPS, Viz	28,500.00	2,530.00	1,500.00	2100	34,630.00	94,400	104,400	151,000		
Mount Pleasant	MOP	1999	VC	2014	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz	65,000.00	3,520.00	500.00	2100	71,120.00	122,000	132,000	151,000		
Cadillac	CAD	2000	VC	2015	ultra winds, UPS, Viz, Tip Bkt	31,000.00	2,860.00	1,000.00	2100	38,960.00	94,400	104,400	151,000		
Marquette	SAW	2000	VC	2015	T/DP, radio, UPS, Viz	31,000.00	2,860.00	3,000.00	2100	38,960.00	100,400	110,400	151,000		ACU, UG and UHF, snow plat
Saginaw	HYX	2000	VC	2015	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,000.00	2100	77,980.00	122,000	132,000	151,000		
Beaver Island	SJX	2001	VC	2016	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	2,500.00	2100	79,480.00	122,000	132,000	151,000		
Charlevoix	CVX	2001	VC	2016	Baro, Cello, radio, ultra winds, UPS, Viz, Tip Bkt	68,200.00	3,850.00	2,000.00	2100	76,150.00	122,000	132,000	151,000		
Charlotte	FPK	2001	VC	2016	Baro, T/DP, radio, ultra winds, UPS, Viz	38,200.00	3,520.00	500.00	2100	44,320.00	94,400	104,400	151,000		
Cheboygan	SLH	2001	VC	2016	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,500.00	2100	78,480.00	122,000	132,000	151,000		
Harbor Springs	MGN	2001	VC	2016	Baro, Cello, radio, ultra winds, UPS, Viz, Tip Bkt	68,200.00	3,850.00	2,000.00	2100	76,150.00	122,000	132,000	151,000		
Lambertville	DUH	2001	VC	2016	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,000.00	2100	77,980.00	122,000	132,000	151,000		
Port Huron	PHN	2001	VC	2016	Baro, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	40,700.00	3,850.00	1,000.00	2100	47,650.00	94,400	104,400	151,000		remote comm bridge
Caro	CFS	2004	VC	2019	Baro, Cello, radio, ultra winds, UPS, Viz, Tip Bkt	68,200.00	3,850.00	1,000.00	2100	75,150.00	122,000	132,000	151,000		
Frankfort	FKS	2004	VC	2019	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,500.00	2100	78,480.00	122,000	132,000	151,000		
Owosso	RNP	2004	VC	2019	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	500.00	2100	77,480.00	122,000	132,000	151,000		
Rogers City	PZQ	2004	VC	2019	Baro, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	40,700.00	3,850.00	2,000.00	2100	48,650.00	94,400	104,400	151,000		
South Haven	LWA	2004	VC	2019	Baro, Cello, radio, ultra winds, UPS, Viz, Tip Bkt	68,200.00	3,850.00	1,500.00	2100	75,650.00	122,000	132,000	151,000		
Troy	VLL	2004	VC	2019	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,000.00	2100	77,980.00	122,000	132,000	151,000		remote winds
Drummond Island	DRM	2005	VC	2020	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz	68,200.00	3,850.00	2,000.00	2100	76,150.00	122,000	132,000	151,000		
Howell	OZW	2005	VC	2020	Baro, T/DP, radio, ultra winds, UPS, Viz	38,200.00	3,520.00	500.00	2100	44,320.00	94,400	104,400	151,000		non-std site plan, site leans
Three Rivers	HAI	2005	VC	2020	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	70,700.00	4,180.00	1,000.00	2100	77,980.00	122,000	132,000	151,000		
Fremont	FFX	2007	VC	2022	Baro, Cello, ultra winds, UPS, Viz, Tip Bkt	65,000.00	3,520.00	1,000.00	2100	71,620.00	122,000	132,000	151,000		
Midland	IKW	2008	VC	2023	Baro, Cello, T/DP, radio, ultra winds, UPS, Viz	68,200.00	3,850.00	1,000.00	2100	75,150.00	122,000	132,000	151,000		
Ionia	Y70	2009	VC	2024	Cello, T/DP, radio, ultra winds, UPS, Viz	64,200.00	3,520.00	500.00	2100	70,320.00	122,000	132,000	151,000		remote winds
Lapeer	D95	2012	VC	2027	T/DP, radio, ultra winds, UPS, Viz	34,200.00	3,190.00	1,000.00	2100	40,490.00	94,400	104,400	151,000		
West Branch	Y21	2016	VC	2031	ultra winds, UPS, Viz	28,500.00	2,530.00	1,500.00	2100	34,630.00	94,400	104,400	151,000		
AERO Workbench	EFU	all time	VC	anytime	Baro, T/DP, radio, ultra winds, UPS, Viz, Tip Bkt	40,700.00	NIC	NIC		40,700.00	94400	94400	100000		

OLD Processor - Short Lifespan remaining	→	TOTAL PHASED UPGRADE by MDOT	2,238,580.00
NEW Processor - Long Lifespan remaining	→	TOTAL VAISALA Replacement by MDOT	4,430,600
NEW Processor - Long Lifespan remaining	→	TOTAL VAISALA Replacement by Contract	4,840,200
NEW Processor - Long Lifespan remaining	→	TOTAL All Weather INC replacement by Contract	6,291,000

illary equipment to replace	cost
Cabinet door seals,	\$200
Battery Box	\$700
DN sensor/mounts	\$200
Aspirators?	\$1,000
TOTAL	\$2,100

Components	Cost	Labor hrs	Labor Cost	Contract Labor
Baro, inc vent, iSI	\$4,000	3	330	
Cello, inc iSI	\$30,000	3	330	
Temp/Dewpoint (TDP), inc harness, iSI	\$2,500	3	330	
Radio - AWOS2000 inc backplane/mount, harness, antenna/coax	\$3,200	3	330	
Ultrasonic Winds - WM1702 inc harness, iSI, mount/crossarm	\$7,000	10	1100	
UPS - Triple inc harness, battery harness	\$1,500	3	330	
Visibility/Pres Wx (Viz) - inc Harness, mount, iSI	\$20,000	10	1100	
Tipping Bucket - TR-525 inc harness, ancillary, iSI, mount	\$2,500	3	330	
			0	
Whole site Vaisala upgrade, new processor - Est only -	\$85,000	60	6600	9600
Whole site All Weather INC upgrade, earthwork, new processor - Est only-	\$130,000	120	13200	21000
Travel costs - \$250/person/day/hr away	1	2	3	4
	500	1000	1500	2000
			4	5
			2000	2500
				6
				3000