

Rural Training Center-Thailand Mobile Emergency Weather Station: Technical Paper

Sparky, the Batt-mobile MEWS Capabilities



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Sparky is the RTC-TH alternative energy demonstration vehicle and EmComm (emergency communications) vehicle. Part of Sparky's EmComm capability is MEWS (the Mobile Emergency Weather Station). This paper describes those capabilities.

Sparky would be deployed within a round-trip operating radius of 20 km from the main RTC-TH base of operations. This allows for about 50% reserve battery capacity to operate Emcomm equipment



Sparky, the Batt-mobile

and still have enough battery power to return to base for recharging. The plan would be to deploy Sparky to pre-determined portable operating sites that are considered "safe sites", emergency shelter sites, or emergency helicopter landing zones. Provisioning plans call for 2 days for 2 people before returning to base for re-supply.



Most of Sparky's primary MEWS equipment is mounted on the above dash bracket. (L to R) Seiko weather station, Strike Alert lightning detector, barometric altimeter, magnetic compass, bi-axial tilt meter, GPS.

Redundancy is part of the planning for MEWS. Often advanced instruments require power from batteries or other electrical supply source. Backup systems begin with replacement power supply or manual systems using no electrical power. The aim is to select systems and backups enabling Sparky to continue providing Advanced level MEWS reports if a primary equipment item fails or is damaged. The bottom line, worst case scenario is to fall back to Basic level MEWS observations and reports which are capable of providing minimal emergency flight weather data.

;	Sparky's Adv	ance	ed level N	IEWS primary	and back-up systems			
Obse	rvation / Measurer	nent		Primary	Back-up			
1	Location		GPS -		Topographic Map			
I	Date / Time			ko WF 100	Calendar, mechanical wrist watch			
	2.1 Air Temp (dry))	Seli	KU WE 100				
	2.2 Wet Bulb Tem	ıp			Hygrometer			
	2.3 Temp differen				Trygrometer			
2	2.4 Relative Humi	dity		of the second				
	2.5 Dew Point Ter	np.	AT All	Kestrel 4500NV	Hygrometer, Dew Pt. chart			
	2.6 Heat Stress In		y ale	Restret 4500NV	Hygrometer, reference charts			
	2.7Wind Chill Inde	ex			Dwyer wind gauge, Wind-chill chart			
	3.1 Ave wind sp	eed	ASSESSED		Dwyer wind gauge, Beaufort wind			
3	Gusts	annuny ,			chart			
3	3.2 Wind direction		Kestrel 45	500 with wind vane	Sparky roof mounted wind vane,			
1	Gust direction	n		accessory	magnetic compass			
	4.1 Cloud cover			vation and Cloud cov	The state of the s			
	4.2 Cloud base he	eight		alculation method	Cloud reference chart			
# 1	4.3 Cloud type			vation and Cloud cov				
4	4.4 Rainfall			mounted gauge	Ground/post mounted gauge			
88	4.5 Visual range	7 8		ned from map study	The second secon			
8 8	4.6 Severe weath	er		Lightning Detector	Flash / Boom estimation method			
				vation and Cloud type				
					t and Power Supply			
	Equipment	Prim	nary Power	Secondary Power	Manual Back-up			
C	Garmin II GPS (4)		AA batteries	Spare batteries 12 VDC vehicle power				
K	estrel 4500NV	(2)	AA batteries		Dwyer Wind gauge, hygrometer, sling psychrometer			
	WF110 Forecaster	(4)	AA batteries	Spare batteries	Thermometer, hygrometer, altimeter, sundial, calendar, mechanical watch			
Strik	ke Alert Lightning Detector	(2) A	AA batteries		Flash / Boom method			

MEWS observations are not truly mobile (i.e. on the move). RTC-TH MEWS is actually a stop 'n park operation. The ability to relocate Sparky / MEWS gives flexibility to provide on-site weather data from a variety of sites in a disaster area. If Sparky cannot access the area, Basic MEWS observers could go in by foot, bicycle, and motorbike or even by raft or boat if needed.



Garmin II GPS Unit Latitude, Longitude, Altitude, Date, Time, Azimuth



Back up: topographic maps ,mechanical wristwatch, magnetic compass



Seiko WX station Time, Date, Dry Air Temp, Barometric trend, forecast graphic icons



Strike Alert lightning detector



Back up: hygrometer, altimeter: Dry and Wet bulb temperatures, relative barometric pressure changes, and reference charts



Kestrel 4500, a handheld portable fully integrated weather station



Back up: hygrometer, Dwyer wind gauge and various reference charts



Kestrel 4500 with wind vane accessory mounted



Back up: Roof mounted wind vane and compass







Back up: post mounted rain gauge or empty jar and ruler

Basic Vehicle Orientation for MEWS

Whenever possible, park Sparky pointed to the north when preparing to make MEWS observations. This makes it easier to determine wind directions when using the roof mounted wind vane. [Note: For frequent stop 'n park recon work, this will be faster than setting up the Kestrel 4500NV wind vane.]

Where to Stop 'n Park:

In order for MEWS observations to conform as closely as possible to meteorological standards, use the guidelines in the table below. MEWS is not a replacement for official government weather stations. The data provided are a supplement to official weather reports.

The key advantage of MEWS is being on-site in the disaster area.

It is especially important to follow the guidelines as much as possible if operating in support of an emergency helicopter landing zone LZ.

[Note: Rotor downwash can

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Stop 'n Park Guidelines										
Weather variable	Observation Site Guideline									
Temperature	 Level area 									
Relative Humidity	 standoff 4X height of tall trees/buildings 									
Heat Stress	 30 m away from paved surfaces 									
Rain	 Be surrounded by 9m of short grass or 									
Wind speed	bare soil									
Wind direction	 Thermometer must be shaded 									

produce winds in excess of hurricane intensity. Be sure all equipment is secured for these high wind conditions. Position the MEWS operation outside the LZ and if possible, with a clear view of the approaching/landing pilot, the LZ and the LZ approaches and departure corridors.

MEWS Observations:

MEWS observations are done 3 times a day (e.g. local sunrise, Mid-afternoon, usually between 3-4pm, and local sunset). When directly supporting helicopter LZ operations, additional observations would be made and reported before landings and take-offs, or when severe weather conditions arise. Helicopter flight operations are difficult in mountainous terrain or when pilots fly in unfamiliar areas. Part of the reason for MEWS is to try to improve flight safety during emergency operations



MEWS can support emergency helicopter flight ops with relevant flight weather reports.

MEWS can also provide other useful weather data. Heat stress indices and windchill data can be important in coordinating relief supplies to meet the needs of survivors.

Other Equipment:

In addition to an amateur VHF radio and MEWS equipment, Sparky has other emergency signaling equipment:



Magnetic roof mounted halogen rotating yellow beacon.



Public Address system.



Signal mirror and CD backup reflector



2-color high visibility ground signal panels



High intensity xenon strobe LZ marker with alternate clear lens; (turned off once landing is in progress).



Orange wind streamer (for use at an LZ) to be located upwind of LZ touchdown spot.



PVC reflector wands for night traffic control or LZ aircraft marshalling (each wand has a red and a green face)



Safety vests for MEWS operators (orange for day, reflector vest for night)

In its commitment to community-based education and community service, the RTC-TH is willing to provide MEWS training to any interested Ham radio operators free of charge via e-tutoring (e.g. email or Skype). Small group instruction is available at cost either at RTC-TH facilities or at a host group site. If training off-site, we ask that room and board be provided in addition to any materials costs associated with the training. Contact us at rtc2k5@gmail.com to arrange for MEWS training.

The reference tables used for MEWS observing and reporting are found at the end of this paper.

MEWS is part of the RTC-TH EmComm program. The slogan of the EmComm program is "Ready to Serve and Sustain Our Community." Keeping Sparky, MEWS capable and ready to go is another tangible measure of our commitment to supporting our local community.

[Note: The reference charts used in MEWS observations are included in this paper.

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Sky Conditions	4.1 4.2 4.3 4.4	Steady W Directic Variable V Directic Cloud Co Use loca Cloud Bas (Loc Re Cloud Ty Rainfa Visual Ra (Visibilit	Vindon Windon Vindon Over Il make Hitel) In Vipe	ti i	Circle directicome Circle 1 or r wind co Use Defini Cow ntain of know. Relative DewCal (2.1 n. flight akituu High Middle Low Measur Name of Name of	ion steady wind as FROM more directions mes FROM citions in Clouder Table win elevation (about to local Mtn m AMSL -2.5)/9.8×1000m des: Day = 160/y Developed version at 0,900 hrs e 3.2 km mark	N NE E SE N NE E SE Clear Scattered Broken Clouds al Clouds al Clouds at Clouds at Rain Haze Rain Haze Rain Haze Ryes	S SW W NW S SW W NW Cloudy Clo	N NE E SE N NE E SE Clear Scattered Broken report clouds at Clouds at Clouds at Clouds at Clouds at Rain Haze Rain Haze Rain Haze Skm/3 miles	S SW W NW S SW W NW Cloudy Cloudy Covercast Sabove, at, o ove mtn mtn top ellow mtn m AGL ud ceiling = CuNim Cumul 24 hrs. a less than a Fog Smoke	N NE E SE N NE E SE Clear Scattered Broken Clouds ab Clouds ab Clouds ab Clouds ab Clouds ab Roman Stratus Normal	S SW W NW S SW W NW Cloudy Overcast Intain top. Intain
Sky Conditions	4.1	Steady W Directic Variable V Directic Cloud Co Use loca Cloud Bas (Loc Re Cloud Ty Rainfa Visual Ra (Visibilit	Vindon Windon Wi	ti i	Circle directicome Circle 1 or r wind co Use Defini Cow Relative DewCal (2.1 n. flight altitut High Middle Low Measur Name of Name of	on steady wind as FROM more directions mes FROM tions in Cloud er Table on elevation (abort to local Mtn m AMSL -2.5)/9.8x1000m des: Day = 160o Vertically Developed Vertically Developed f 5 km mark f 5 km mark risibility: Day = 3 derstorms Flash, count secs to boom / 3	N NE E SE N NE E SE Clear Scattered Broken Clouds al Clouds al Clouds at Clouds by AGL; Nigh This is a characteristic and the companies of the	S SW W NW S SW W NW Cloudy Clo	N NE E SE N NE E SE Clear Scattered Broken report clouds at Clouds at Clouds at Clouds at Clouds at Rain Haze Rain Haze Rain Haze Skm/3 miles	S SW W NW S SW NW Cloudy Overcast Sabove, at, of over mtn mtn top ellow mtn m AGL ud ceiling = CuNim Cumul 24 hrs. a less than a Fog Smoke a less than a Fog Smoke a less than a Fog Smoke a SSW W NW km	N NE E SE N NE E SE N NE E SE Clear Scattered Broken Clouds ab Clouds ab Clouds at Clouds be No flights. Cirrus Altostrat Altocum Stratus Nimstrat more Rain Haze more Rain Haze Obility = No flig Yes N NE E SE S	S SW W NW S SW W NW Cloudy Overcast Intain top. Dove mtn mtn top Blow mtn m AGL CuNim Cunul Intain top. Intain

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All weather observers write their initials and clearly print their name using block letters										

M.E.W.S. Summary Weather Observation Log Instructions

Header

Location: Local Place Name

Latitude, Longitude from GPS, survey records or map measurement.

Elevation: Survey records or map measurement

(GPS elevations are not reliable).

RTC-TH M.E.W.S. Weather Observation Log Weather Observations Time Sunset Sunrise Mid-Afternoon Observer (misal; see back)

Date/Hour: Use local Thai standard time in Observer: initials in box. Full name (print clearly) on top/back of form 24-hour format

Temperature / Relative Humidity

- 2.1 Air (Dry Bulb) Temp: Read thermometer kept in the shade, 1.5 m above the ground.
- 2.2 Wet Bulb Temp from hyrgrometer kept in the shade, 1.5 m above the ground.
- 2.3 Difference between Dry and Wet Bulb
- 2.1 Air (Dry bulb) 置 2.3 Difference 2.5 Dew Point 2.6 Heat Stress 2.7 Wind Chill
- 2.4 Relative Humidity: Use Dry Bulb Temp (2.1), Difference (2.3) and Relative Humidity table to find % Relative Humidity.
- 2.5 Dew Point Temperature: Use Dry Bulb Temp (2.1), Difference (2.3) and Dew Point Temp table to find Dew Point Temp.
- 2.6 Heat Stress Temperature: Use Dry Bulb Temp (2.1), % Relative Humidity (2.4) and Heat Stress Index Table to find Heat Stress Temperature and relevant advisory warning.
- 2.7 Wind Chill: Use the Dry Bulb Temp (2.1) and Wind Speed (3.1) and Wind Chill Table to find the Wind Chill Temperature and relevant advisory warning.

Wind Speed / Direction

3.1 Average and Gust Wind speeds: Use Beaufort Table or direct measurements 3 times and average results. Gusts are short, strong blasts of wind. Report wind speeds in knots to air crews. Advise air crews when wind speeds are close to affecting

helicopter flight operations.

			Report wind apear	d in A	nots	to ai	r crei	W8;	ımı'n t	lo all	other	8.			
Direction		Average	Get 3 readings & average		km/h		knts		km/h		knts		km/h		krts
å	3.1	Guete	Record highest gust		km/h		knts		kmh		knts		km/h		krts
/poods			Wind Speed Guid	eline	s fo	r Hel	icop	ter l	ligh	t Op	erati	ons			
å	1	10 kmo	ts / 18.5 km/h ideal; OK	to fly			ΑI	bove	45 kı	nots /	83 k	m/h;	No fli	ghts.	
F.		Gusts abo	ive 20 knots/ 37 km/h; N	Vo flig	hts	_	Max	taily	rind 5	knot	ts/8 k	km/hr	, No t	ake i	əff
=		Steady Wind	Circle direction steady wind	N	NE	3	SW	N	NE	9	SW	N	NE	9	SW
ان	3.2	Direction	comes FROM	Ε	SE	W	NW	E	5E	W	NW	E	SE	W	NW
`	32	Variable Wind	Circle 1 or more directions	N	NE	S	SW	N	NE	5	SW	N	NE	5	SW
ш		Direction	wind comes FROM	Ε	SE	W	NW	E	3E	w	NW	E	SE	W	NW

3.2 Steady or Variably blowing winds. If steady, circle letter for direction. If variable, circle all appropriate letters for directions

Sky Conditions

- 4.1 Cloud cover: Look at the sky and follow the definitions for each cloud cover classification.
- 4.2 Cloud Base Height: If relative to a local mountain, give its name and elevation above mean sea level. Note Local Relief in meters. If using the Dew Point method, subtract Dew point temp (2.5) from Dry temp (2.1) and divide result by 9.8; multiply quotient by 1000m. Advise air crews when cloud base height (ceiling) are close to affecting helicopter flight operations.
- 4.3 Cloud Type: Check the appropriate box based on cloud description in the guide book

_		W. C. S. S. S. S. S.								
	4.1	Cloud Cover		nitions in Cloud ver Table	□ Clear □ Scattered □ Broken	□ Cloudy d □ Overcest	□ Clear □ Scattered □ Broken	□ Cloudy □ Overcast	Clear Scatter Broken	□ Cloudy ed □ Overcast
		Use local mou	ntain of know	wn elevation (ab	ove mean so	ea level) and	report doud	s above, at, o	or below m	ountain top.
		Cloud Base Ht	Rolative	to local Min	r: Clouds at	bove mfn	□ Clouds al	bove min	□ Clouds	above min
	4.2	(Loc Rel)			□ Clouds at	t into top	□ Clouds at	min top	□ Clouds	at min top
	4.2			m AWSL	□ Clouds b	elow mtn	□ Clouds b	nten wole	c Clouds	below mitn
		m	DewCell (2:	1-2.5y9.8x1000m		m AGL		AGL		m AGL
		Mi	n. Might altitu	ides: Day = 160:	π AGL; Nigl	fat – 500 m Ai	GL: Low alo	ud ceiling =	No flights.	
2			High		c: Cirrus	DON'm	□ Cirrus	::CuNm :	c Cirrus	. :CuNim
ĝ			Middle	Vertically	ro Altoetrat	DOMNIE	 Altostrat 	DCUNIT :	□ Altostra	t Doursen
펻	4.3	Cloud Type	nelouic	Developed	c: Altocum		:: Altocum		n Allocun	n
8			Low	Developed	n Status	o Cumul	□ Stratus	:: Oumul	n Stratus	. D Cumul
Sky Conditions			2011		o Nimstrat		□ Nimstrat		D Nimstra	t Comme
	4.4	Rainfall	Measu.	ire at 0900 hrs e	ach morning	 Report am 	ount for last	24 hrs.		mm
4			Name of	f 3.2 km mark		a less than		less than	□ more	c) less than
						ci Fog		□ Fog	c: Rain	:: Fog
		Visual Range				□ 3moke		Smoke	o Haze	:: Smoke
	4.5	(Visibility)	Name o	of 5 km mark		a less than		less than	□ more	 less than
						□ Feg		o Fog	□ Rain	□ Fog
						:: Smoke		:: Smoke	n Haze	□ Smoke
		Helicopti	er minimum	visibility: Day = .				es: Low visib		
			Thun	derstorms	r: Yes	□ No	n Yes	E NO	n Yes	13 No
	4.6	Severe	Lightning	Flash, count secs		SSWWNW		S SW W NW		ESSWWNW
	4/0	Weather	change.		□ Yes	km	□ Yes	km	o Yes	km
				Wan	m air crews	of any seve	ve weather	in your area	L.	

- 4.4 Rainfall: Measure water in rain gauge each day at 0900 hrs. Rain gauge should be in open area, away from tall objects, with top of gauge 50 cm above ground to avoid splash water from entering gauge.
- 4.5 Visual Range: Pick landmarks 3.2 km and 5 km from your observation site. Report when visual range is more or less than the known distances to these landmarks. Advise air crews when visual range is close to affecting helicopter flight operations. Check appropriate boxes for reasons of reduced visibility.
- 4.6 Severe Weather: Primary concerns and thunderstorms and lightning. Check the appropriate boxes. If lighting, watch for flash, count seconds until you hear the thunder, divide by 3 = approximate distance in km. Circle direction to storm

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	Relative Humidity Chart for °C Temperatures Dry Bulb Temperature minus Wet Bulb Temperature in °C																			
						Dr	y Bulb	Tem	oeratu	ıre mir	nus W	et Bul	b Tem	perati	ure in	°C				
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	
	-20	70	41	11				7 /			A W									
	-17.5	75	51	26	2		4007	A 100					1000							<u> </u>
	-15	79	58	38	18	σ_{A}	The same						· 100							<u> </u>
	-12.5	82	65	47 🦼	30	13	887 A								1					<u> </u>
	-10	85	69	54	39	24	10								. 10	4				<u> </u>
	-7.5	87	73	60	48	35	22	10								Ø.	l.			
ပွ	-5	88	77	66	54	43	32	21	11	1				A STATE OF THE PARTY OF THE PAR	- 4	S. 1				
(Air Temperature	-2.5	90	80 🦼	70	60	50	42	37	22	12	3			V0000						
atu	0	91	82	73	65	56	47	39	31	23	15			l Timen			100			
era	2.5	92	84	76	68	61	53	46	38	31	24									
dμ	5	93	86	78	71	65	58	51	45	38	32	1		8 10		1000				
e'	7.5	93	87	80	74	68	62	56	50	44	38	11		100		A Second	A W			
	10	94	88	82	76	71	65	60	54	49	44	19				a 1990				
(\ \ <u>\</u>	12.5	94	89	84	78	73	68	63	58	53	48	25	4	900 W						
ව	15	95	90	85	80	75	70	66	61	57	52	31	12							
Ę [17.5	95	90	86	81	77	72	68	64	60	55	36	18	2				Ż		
ଚ୍ଚ	20	95	91	87	82	78	74	70	66	62	58	40	24	8						
اق	22.5	96	92	87	83	80	76	72	68	64	61	44	28	14	1	100	4 8			
en	25	96	92	88	84	81	77	73	70	66	63	47	32	19	7	d 10				
Dry Bulb Temperature	27.5	96	92	89	85	82	78	75	71	68	65	50	36	23	12	1	9 (8)			
필	30	96	93	89	86	82	79	76	73	70	67	52	39	27	16	6				
/ B	32.5	97	93	90	86	83	80	77	74	71	68	54	42	30	20	11	1			
Or,	35	97	93	90	87	84	81	78	75	72	69	56	44	33	23	14	6			
	37.5	97	94	91	87	85	82	79	76	73	70	58	46	36	26	18	10	3		
	40	97	94	91	88	85	82	79	77	74	72	59	48	38	29	21	13	6		
	42.5	97	94	91	88	86	83	80	78	75	72	61	50	40	31	23	16	9	2	
	45	97	94	91	89	86	83	81	78	76	73	62	51	42	33	26	18	12	6	
	47.5	97	94	92	89	86	84	81	79	76	74	63	53	44	35	28	21	15	9	<u> </u>
	50	97	95	92	89	87	84	82	79	77	75	64	54	45	37	30	23	17	11	

- Use the hygrometer to get the Dry Bulb and the Wet Bulb Temperature. Example, Dry Bulb = 30°C, Wet Bulb = 28°C.
- Subtract the Wet Bulb temperature from the Dry Bulb temperature. Example, 30°C 28°C = 2°C. Find the column for 2°C across the top of the chart.
- Locate 30°C in the Air Temperature column at the left side of the chart.
- Find the intersection of the column and row to get the % relative humidity. For the example of 2°C and 30°C, the relative humidity is 86%.

						DE	W POIN	T TEMPI	ERATUR	E CHAF	RT (°C)						
						Dr	y Bulb te	emperatu	re minus	Wet Bu	lb tempe	rature in	°C				
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
	-20	-25	-33					\mathbf{z}									
	-17.5	-21	-27	-38			-	27 ASS			10.	-m-					
	-15	-19	-23	-28		2007 /		F 20000			100 V		D. 10				
	-12.5	-15	-18	-22	-29						2000		700. 7				
	-10	-12	-14	-18	-21	-27	-36					400	THE PERSON NAMED IN				
()	-7.5	-9	-11 🧥	-14	-17	-20	-26	-34		1 1000		Victoria de	Pd	W			
ပွ	-5	-7	-8	-10	-13	-16	-19	-24	-31	a man				A WA			
e l	-2.5	-4	-6	-7	-9	-11	-14	-17	-22	-28	-41		30 Y	B. W.			
(Air Temperature	0	-1	-3	-4	-6	-8	-10	-12	-15	-19	-24			MA Y	i,		
er	2.5	1	0	-1	-3	-4	-6	-8	-10	-13	-16			389 Y			
ď	5	4	3	2	0	-1	-3	-4	-6	-8	-10	-48		4			
ē	7.5	6	6	4	3	2	1	-1	-2	-4	-6	-22					
.⊨	10	9	8	7	6	5	4	2	1	0	-2	-13					
ן ַ	12.5	12	11	10	9	8	7	6	4	3	2	-7	-28				
<u>ə</u>	15	14	13	12	12	11	10	9	8	7	5	-2	-14				
l at	17.5	17	16	15	14	13	12	12	11	10	8	2	-7	-35			
ers	20	19	18	18	17	16	15	14	14	13	12	6	-1	-15			
<u>ā</u>	22.5	22	21	20	20	19	18	17	16	16	5	10	3	-6	-38		
e.	25	24	24	23	22	21	21	20	19	18	18	3	7	0	-14		
Dry Bulb Temperature	27.5	27	26	26	25	24	23	23	22	21	20	16	11	5	-5	-32	
E I	30	29	29	28	27	27	26	25	25	24	23	19	14	9	2	-11	<u> </u>
E E	32.5	32	31	31	30	29	29	28	27	26	26	22	18	13	7	-2	<u> </u>
D.	35	34	34	33	32	32	31	31	30	29	28	25	21	16	11	4	<u> </u>
_	37.5	37	36	36	35	34	34	33	32	32	31	28	24	20	15	9	0
	40	39	39	38	38	37	36	36	35	34	34	30	27	23	18	13	6
	42.5	42	41	41	40	40	39	38	38	37	36	33	30	26	22	17	11
	45	44	44	43	43	42	42	41	40	40	39	36	33	29	25	21	15
	47.5	47	46	46	45	45	44	44	43	42	42	39	35	32	28	24	19
	50	49	49	48	48	47	47	46	45	45	44	41	38	35	31	28	23

- Use the hygrometer to get the Dry Bulb and the Wet Bulb Temperature. Example, Dry Bulb = 30°C, Wet Bulb = 28°C.
- Subtract the Wet Bulb temperature from the Dry Bulb temperature. Example, 30°C 28°C = 2°C.
- Find the column for 2°C across the top of the chart. Locate 30°C in the Air Temperature column at the left side of the chart. Find the intersection of the column and row to get the Dew Point Temperature. For the example of 2°C and 30°C, the Dew Point Temperature is 27°C.
- Divide 27°C by 10°C = 2.7 X 1000 m = 2700 m (the altitude of the bottom of the clouds)

		Hea	t S	tress Inc	lex (Sen	sible Te	mp	eratu	re)		
Air Tomp						Rela	tive Humi	dity	/	•		
Air Temp	10%	20%	6	30%	40%		50%	60%		70%	80%	90%
46°C	44°C	49°(<u> </u>	57°C	66	°C						
43°C	41°C	44°(<u> </u>	51°C	58	°C	56°C					
41°C	38°C	41°(<u> </u>	45°C	51	°C	57°C	6	55°C			
38°C	35°C	37°0	<u> </u>	40°C	43	°C	49°C	5	6°C	62°C		
35°C	32°C	34°0	<u> </u>	36°C	38	°C	42°C	4	l6°C	51°C	58°C	
32°C	29°C	31°0	<u> </u>	32°C	34	·°C	36°C	3	88°C	41°C	45°C	50°C
29°C	27°C	28°0	2	29°C	30	°C	31°C	3	32°C	34°C	36°C	36°C
27°C	24°C	25°0	0	26°C	26	°C	27°C	2	28°C	29°C	30°C	31°C
Danger Level	I Cautio	on		II Extreme Caution	Э	III Danger				Extreme Danger		
Heat Index	27-32°	С	A	32-40°C			40-54°C		Abo	ve 54°C		humidity bserved
Heat Syndrome	Fatigue possible with prolonged exposure exl and/or physical activity exposure		Sunstroke, he cramps, or he xhaustion poss with prolonge exposure and/physical activi	at sible d or	exhau strol	unstroke, heat amps, or heat ustion likely; h ke possible wi onged exposu nd/or physical activity	eat th	highl	/ sunstroke y likely with ued exposure	applica condition extre	ally not able but s would be emely erous	

- Use a hygrometer placed in a shaded position about 1.2 m / 5 ft above the ground.
- Air Temperature is read from the Dry Bulb Thermometer.
- Relative Humidity is calculated using the Relative Humidity Table. This requires the following data: Air Temperature and the Temperature Difference between the Dry and Wet Bulb readings.

				g> 10	Wi	nd Chill					
					Measu	red Air Ter	nperatur	e (°C)			
	0	5	0	-5	-10	-15	-20	-25	-30	-35	-40
	5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47
	10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51
	15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54
	20	1	-5	-12	-18	-24	-31	-37	-43	-49	-56
(km/h)	25	1	-6	-12	-19	-25	-32	-38	-45	-51	-57
<u> </u>	30	0	-7	-13	-20	-26	-33	-39	-46	-52	-59
₹	35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60
Velocity	40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61
\e	45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62
g	50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63
Wind	55	-2	-9	-15	-22	-29	-36	-43	-50	-57	-63
>	60	-2	-9	-16	-23	-30	-37	-43	-50	-57	-64
	65	-2	9	-16	-23	-30	-37	-44	-51	-58	-65
	70	-2	-9	-16	-23	-30	-37	-44	-51	-59	-66
	75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66
	80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67
	S CONTRACTOR OF THE SECOND SEC		el can be danç			Frostbi min	te in 30 utes	Frost- bite in	Frostbi	te within 5	minutes
TENT		Use	e heated vehic	cles; tempo	orary	Starts dar	nger of	10 mi	ninutes Adapted by		
No. C	shelters unsuitable and dang					frostbite and	possible de	eath.	G.K. Lee	for RTC-TH	HM.E.W.S.



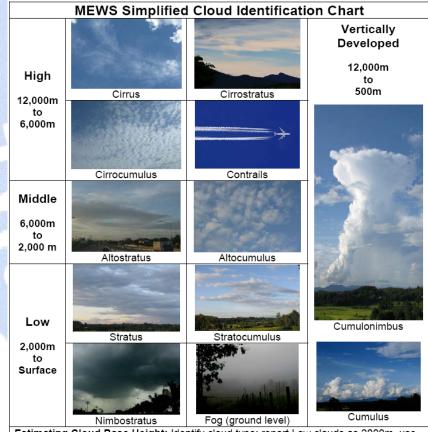
Beaufort Wind Table for Land Effects

MEWS weather observers should set up a flag near their operating position. Use the Description and flag references to estimate the wind speed. Report the range of wind speeds from the chart rather than a specific number.

Speeds I	TOTAL LITE GRALL	autei utati a	Specific	muniber.			
Description	Flag	WMO	Mph	Km/ hr	Knots	Force	Psu lbs/sq ft (Kg/sq m)
		term	R	eport win	d speed i	n knots to	flight crews
Calm; smoke rises vertically		Calm	<1.0	<1.5	<0.9	0	0.006266 (0.003059)
Smoke indicates wind; flag hangs limp, wind vanes do not move	To the second	Light Air	1-3	1.5-6	1-3	1	0.02924 (.01428)
Wind felt on face, leaves rustle, flag stirs, wind	B	Light breeze	4-7	6-12	4-6	2	0.142 (0.6934)
vanes move	" Cu		nots ma	ximum ta	ilwind for	helicopte	er take-off
Leaves and twigs in constant motion; flag	1	Gentle Breeze	8-12	12-20	7-10	3	0.3759 (1.835)
occasionally extends	the or	10	0 Knots	ideal for l	helicopte	r flight op	erations
Dust and paper fly; small branches move; Flag flaps	Per	Mild Breeze	13-18	21-29	11-16	4	0.8145 (3.977)
small leafy trees begin to sway; white crested wavelets appear on		Fresh Breeze	19-24	30-39	17-21	5	1.504 (7.342)
lakes/ponds; Flag ripples	3.0	20 Kno	ts maxir	mum gust	s for heli	copter flig	ht operations
Large branches move; wires whistle; umbrellas hard to use; Flag snaps		Strong Breeze	25-31	40-50	22-27	6	2.485 (12.13)
Whole trees sway; hard to walk; Flag extended		Near Gale	32-38	51-61	28-33	7	3.822 (18.66)
Twigs and small branches broken; cars veer on roads; Flag tatters	2	Gale	39-46	62-74	34-40	8	5.597 (27.33)
Slight structural damage occurs (roof shingles blow		Strong Gale	47-54	75-87	41-47	9	7.769 (37.93)
off)	The state of the s	45 Kno	ts maxin	num wind	s for heli	copter flig	ht operations
Trees broken or uprooted, considerable damage to buildings	N. Service of the ser	Storm	55-63	88-101	48-55	10	10.53 (51.39)
Wide spread damage		Violent Storm	64-72	02-114	56-63	11	13.78 (67.3)
caused		Hurricane	>73	>115	>63	12	>13.78 (>67.3)

Disclaimer: Use of the pressure data to calculate tower/antenna wind loads is at your own risk. The RTC-TH and HSØZHM assume no liability for the use of this data. Pressure values are the upper limits for a wind category.

Table of Cloud Cover Terms					Flash / Boom Storm Distance Estimation
Term	Amount of blue	Amount of cloud			Use this method to estimate the distance to a thunderstorm.
Clear	Nearly all blue	Little or no clouds			 Immediately upon seeing a flash of lightning, count the number of seconds until you hear the boom of the thunder.
Scattered clouds	Mostly blue	Some clouds		-11 1	 Divide the number of seconds by 3 = km estimated distance to the storm
Broken clouds	Big blue patches	Mostly clouds			When the flash and boom are almost
Cloudy	Some blue	Mostly clouds			instantaneous, you may be in big trouble.
Overcast	Little or no blue	Nearly all clouds			People have been struck by lightning 56+ km away from a thunderstorm.



Estimating Cloud Base Height: Identify cloud type; report Low clouds as 2000m, use lower limit for other cloud types.

Flight Advisories: Report flight advisory to air crews for the following conditions.

Low Clouds near or at I60m AGL (day); 500m AGL (Night). No flights if below these minimum limits.

Reduced Visibility: Smoke, dust, haze, fog reducing visual range to 3.2 km (Day) or 5 km (Night); No flights if below these minimum limits.

Severe Weather: Thunderstorms, lightning, heavy rain, excessive winds, or other weather extremes.