

**PRELIMINARY TECHNICAL REPORT ON THE WIND PATTERN BEHAVIOR IN THE AREA PROPOSED FOR THE CONSTRUCTION OF THE INTERNATIONAL AIRPORT IN ARGYLE, SAINT VINCENT IN TWO (02) PHASES OF STUDIES, CARRIED OUT FROM 7<sup>TH</sup> MARCH 2006 TO 12<sup>TH</sup> JULY 2008.**

**Introduction:**

The present technical report on the wind study in Argyle, contains the tracking of the Aeolian pattern and its zonal variation, generated by dynamic meteorological factors with incidences in the air flow from the 7<sup>th</sup> of March 2006 to the 12<sup>th</sup> July 2008. The contents reflect a series of observations registered by a universal anemograph FUESS brand and three (03) automatic weather stations on (Head 020°, Head 200° and Central Station IADC), very close to the projected centre line of the runway of the new International Airport in the Argyle region.

The atmosphere is a fluid that is rarely at rest. Due to this irregular distribution of the temperature, the air masses move in all the directions. This phenomenon is known as the wind and to define it from the physical point of view, it is the speed of air particles; consequently it is a vector that is defined by its direction and intensity. The direction is expressed in sexagesimales degrees, that is to say, according to a graduated circle of 360°, describing from where the wind comes. In the maneuvers of takeoff and landing, the wind direction is referenced to the Magnetic North. The intensity of the wind in the present document is expressed in knots (Kts).

**General Objective:**

To determine, by studying the hourly weather observations of the wind pattern, the diversity or the predominant vector of the wind flow for the construction of the Argyle International Airport.

## Presentation of the results for Head 020°:

The automatic weather station is located in an area next to the 020° head at a height of 86 meters above sea level between the following coordinates: 13° 08' 28" North latitude and 61° 09' 20" West longitude and where in a period of eighteen (18) months, 696 903 observations of the wind pattern were registered from the 7<sup>th</sup> of March 2006 to the 12<sup>th</sup> of July 2008. This data was taken in a sequential form in minute by minute intervals by the weather station and detailed with descendent percentage values in the following Chart N° 01.

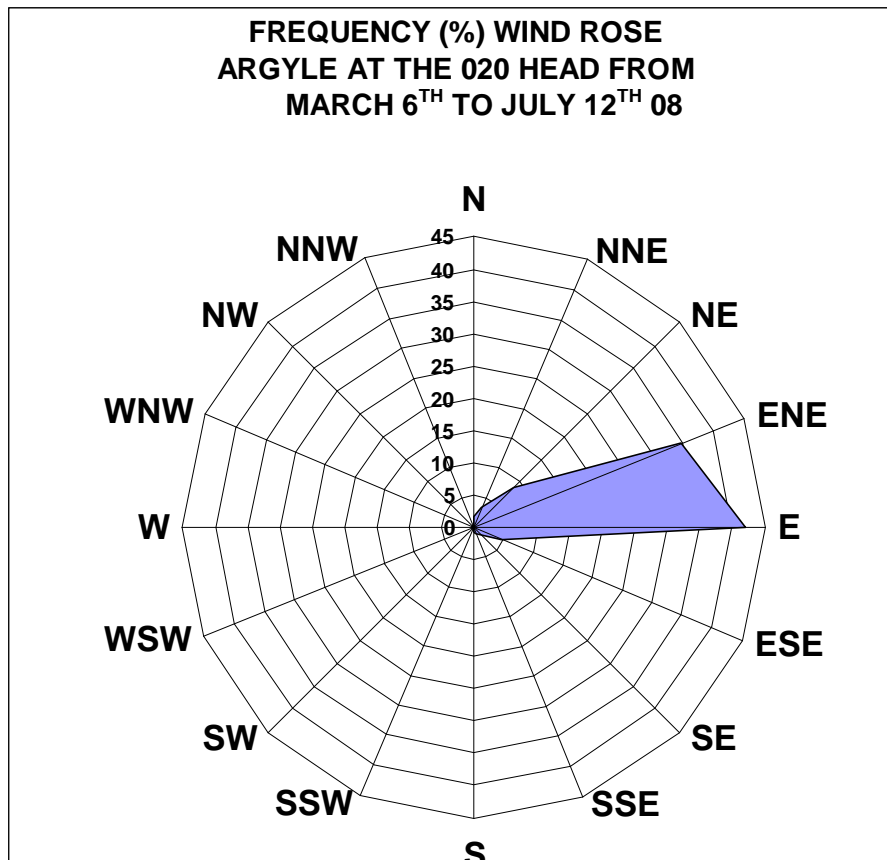
Direction	Radial	Symbol	%
North	350°, 360°, 010°	N	1,564623
North/Northeast	020°, 030°	NNE	3,384062
<b>Northeast</b>	<b>040°, 050°</b>	<b>NE</b>	<b>8,868349</b>
<b>East/Northeast</b>	<b>060°, 070°</b>	<b>ENE</b>	<b>34,62659</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>41,81181</b>
East/Southeast	110°, 120°	ESE	4,825868
Southeast	130° y 140°	SE	1,58514
South/Southeast	150°, 160°	SSE	1,009508
South	170°, 180°, 190°	S	0,738479
South/Southwest	200°, 210°	SSW	0,273755
Southwest	220°, 230°	SW	0,26816
West/Southwest	240°, 250°	WSW	0,136734
West	260°, 270°, 280°	W	0,218373
West/Northwest	290°, 300°	WNW	0,210769
Northwest	310°, 320°	NW	0,267873
North/Northwest	330°, 340°	NNW	0,209908

**Chart N° 01:** 020° Head from 07<sup>th</sup> March 06 to the 12<sup>th</sup> July 08

### Brief Synopsis of the Data:

In the following observation point on the 020° Head, a predominant wind direction from the East (**E**) is appreciable with a percentage of 41.81%. Second component in terms of predominance is that of the East/Northeast (**ENE**) with 34.63% and the third is the wind component from the Northeast (**NE**) with 8.87%.

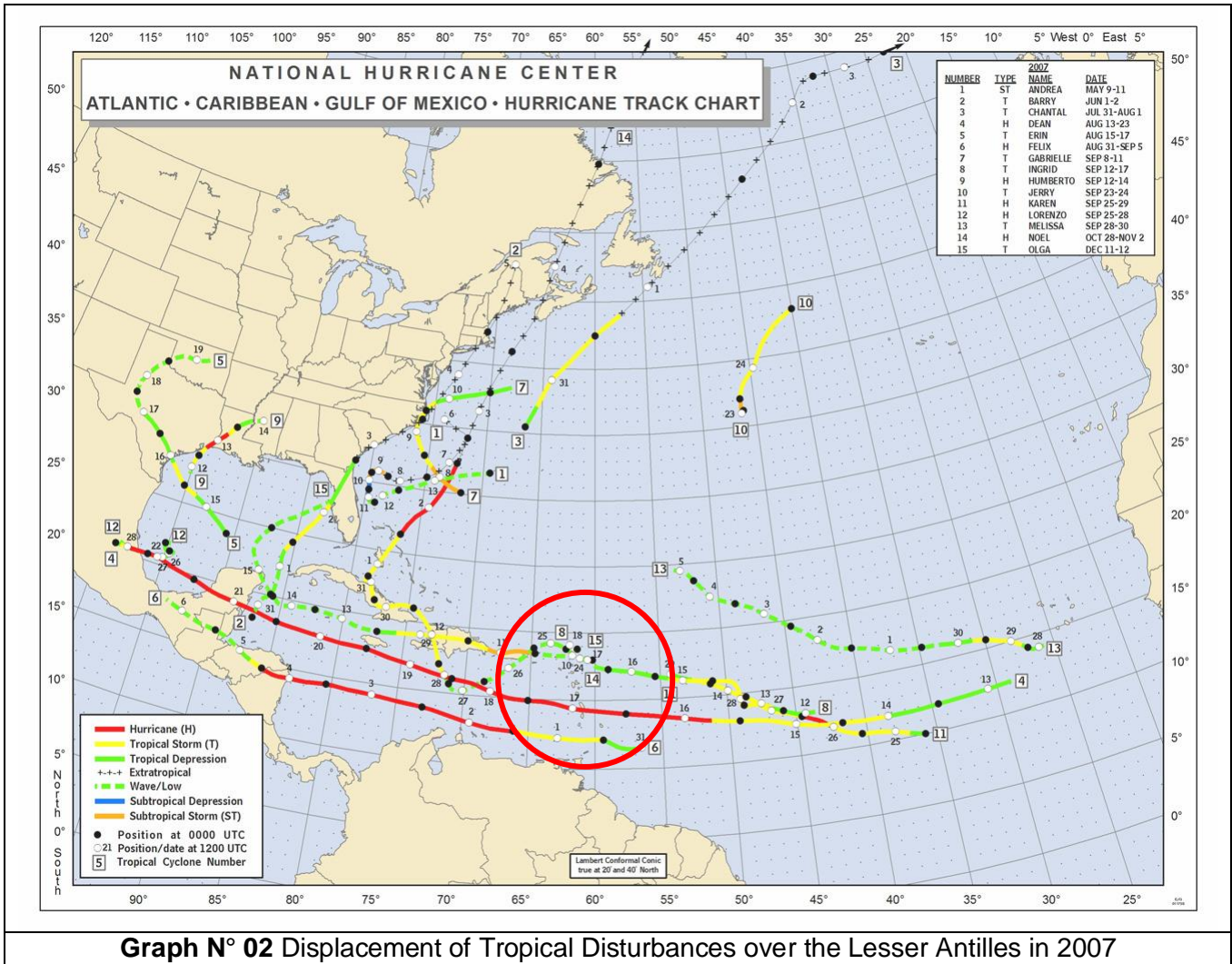
You can also conclude that the three (03) wind components mentioned sum up to a percentage of 85.31%, clearly revealing the predominance of the Easterly flow towards the first quadrant of the wind rose. The remaining thirteen (13) wind components are distributed among the other thirteen (13) radials of the wind rose with a percentage tendency of 14.69% that oscillates between 4.83% and 0.26816%, which do not represent any significant change on the dominant flow from the East, as you can see in Graph N° 01.



**Graph N° 01 Wind Rose**  
020° Head from the 7<sup>th</sup> March 6<sup>th</sup> to 12<sup>th</sup> July 08

In terms of the wind intensity during this period of study, an absolute maximum of 46 Kts was obtained, precisely on the 2<sup>nd</sup> of February 2008, which was motivated by a slight atmospheric instability in the Eastern region of the Lesser Antilles, which brought as a consequence, the variation of the barometric field in the troposphere, but you must note that this registry of the wind intensity was exclusively for that date. Nevertheless, the months in question, from August to the beginning of November 2007, show absolute maximum values very occasionally above 30 Kts and in exceptional cases registries of micro wind gust reaching values of 53 Kts in a period of eleven (11) consecutive minutes from 22:14 to 22:25 Hours (it is to note that these registries of wind gust of 53Kts were not maintained seing that the absolute maximum values corresponding to these readings, shows readings between 18 and 20 Kts) and in the same way, marks a reduction of the wind intensities towards the end of the month of November with an average speed (average of the extreme daily values) of 23.4Kts during this period.

The real cause in terms of the wind intensity, obey the fact that in the months previously mentioned, are influenced by the activity of tropical disturbances (Tropical Storms and Hurricanes), such as: Dean, Felix and Noel in the Hurricane Season of 2007, in addition to the tropical waves that are more intense in the tropical Caribbean region as you can see in Graph N° 02.



From the same appear a series of representative graphs of the maximum and average wind intensities, as are demonstrated in graphs 03a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k, 3l, 3m, 3n, 3ñ, 3o, 3p and 3q, corresponding to the months of February 2007 until July 2008.

## Presentation of the results of 200° Head:

Within the time period from the 13<sup>th</sup> of April 2006 to the 12<sup>th</sup> of July 2008, 726 871 pieces of wind data were obtained, taken from the weather station located at the 200° Head, located between the coordinates 13° 10' 28" North Latitude and 61° 08' 68" West Longitude.

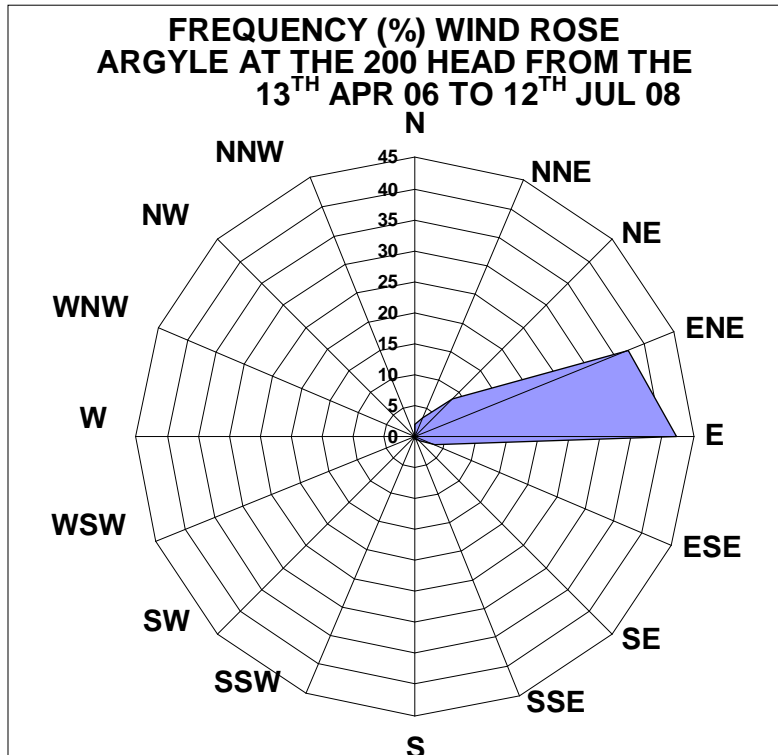
The data collected relate to a population of 100% of information and distributed in this preliminary report of the wind study between the sixteen (16) directions of the Wind Rose, where you can see the following distribution in the Chart N° 02:

Direction	Radial	Symbol	%
North	350°,360°, 010°	N	2,035299
North/Northeast	020°, 030°	NNE	3,137833
<b>Northeast</b>	<b>040°,050°</b>	<b>NE</b>	<b>8,596161</b>
<b>East/Northeast</b>	<b>060°,070°</b>	<b>ENE</b>	<b>37,3168</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>42,21244</b>
East/Southeast	110°,120°	ESE	3,386296
Southeast	130° y 140°	SE	0,880074
South/Southeast	150°, 160°	SSE	0,368016
South	170°, 180°, 190°	S	0,445471
South/Southwest	200°, 210°	SSW	0,250251
Southwest	220°, 230°	SW	0,175547
West/Southwest	240°,250°	WSW	0,070989
West	260°, 270°,280°	W	0,113087
West/Northwest	290°,300°	WNW	0,301704
Northwest	310°, 320°	NW	0,388239
North/Northwest	330°, 340°	NNW	0,32179

Chart N° 02: 200° Head from 13<sup>th</sup> April 06 to the 12<sup>th</sup> July 08

## Brief Synopsis of the Data:

The summary of the wind study in the Argyle region corresponds to the observations conducted at the 200° Head, with the three (03) predominant with directions at this study point highlighted with colors. The East (**E**) component predominates with a percentage of 42.21%, followed by the flow of the predominant wind from the East/Northeast (**ENE**) with 37.32% and the wind direction from the Northeast (**NE**) with 8.60%. Adding up these three (03) close or consecutive wind directions, you get a percentage of 88.13%, clearly demonstrating the predominance of the wind flow towards the first quadrant of the wind rose. The rest of the other wind components is distributed among the thirteen (13) remaining radials of the wind rose with a percentage tendency of 11.87% oscillating between 3.39% and 0.070989%, which do not represent any significant change on the dominant flow from the East, as you can see in Graph N° 04.



**Graph N° 04** Wind Rose  
200° Head from 13<sup>th</sup> April 06 to 12<sup>th</sup> July 08

The wind intensity during the period in study obtained an absolute maximum of 40 Kts, exactly on the 1<sup>st</sup> of August 2007, provoked by the passage of tropical disturbances over the region of the Lesser Antilles, causing variation of the Aeolian field in the region. This is a consequence of the fact that the months in question from August to October, presented occasional values above 30 Kts and progressively reduced its intensities towards the end of the month of November. In the same way, the average wind speed (average of the daily extreme values) was of 23.8 Kts during the period of study.

The real cause of the variation in wind intensity obeys the fact that in the months previously mentioned, you have the influence of the activities of tropical disturbances (Tropical Storms and Hurricanes), that are more intense in this tropical Caribbean region. The same present a series of representative graphs of the maximum and average wind intensities, as are demonstrated in graphs 05a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j, 5k, 5l, 5m, 5n, 5ñ, 5o, 5p and 5q, corresponding to the months of February 2007 to July 2008.

In terms of wind intensity during this period, an absolute maximum of 40 Kts was obtained on the 1<sup>st</sup> of August, influenced by the passage of tropical disturbances over the region of the Lesser Antilles and in the same way the average wind speed during this period of evaluation was 23.8 Kts.

### Presentation of the results at the Central Station at IADC Office:

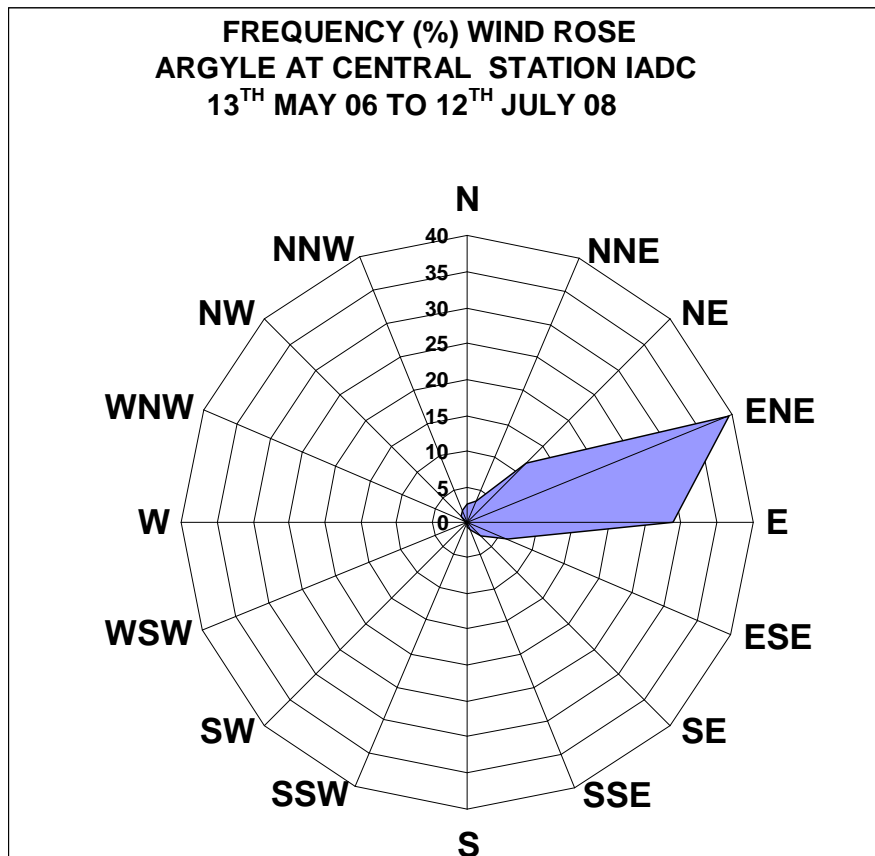
Following is Chart N° 03, corresponding to the distribution of the sixteen (16) different wind directions at the Central Station at IADC, located within the coordinates 13° 09' 97" North Latitude and 61° 08' 64" West Longitude at a height of 16 meters above sea level, contributing some 728 965 pieces of wind data. The following variation of the wind field is reflected in Chart N°03:

Direction	Radial	Symbol	%
North	350°,360°, 010°	N	2,546076
North/Northeast	020°, 030°	NNE	3,257358
<b>Northeast</b>	<b>040°,050°</b>	<b>NE</b>	<b>11,57134</b>
<b>East/Northeast</b>	<b>060°,070°</b>	<b>ENE</b>	<b>39,48982</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>28,81483</b>
East/Southeast	110°,120°	ESE	6,065175
Southeast	130° y 140°	SE	2,771464
South/Southeast	150°, 160°	SSE	0,981666
South	170°, 180°, 190°	S	0,648179
South/Southwest	200°, 210°	SSW	0,15913
Southwest	220°, 230°	SW	0,133477
West/Southwest	240°,250°	WSW	0,0915
West	260°, 270°,280°	W	0,15666
West/Northwest	290°,300°	WNW	0,362157
Northwest	310°, 320°	NW	1,13229
North/Northwest	330°, 340°	NNW	1,81888

**Chart N° 03:** Central Station IADC from the 13<sup>th</sup> May 06 to the 12<sup>th</sup> July 08

### Brief Synopsis of the Data:

The study and analyses of the wind at the Central station near the IADC, correspond to a population of 728 965 pieces of wind data, product of the observations made from the 13<sup>th</sup> of May 2006, where the following results were obtained. The three (03) most representative directions were emphasized with colors in the Chart N° 03, where the East/Northeast (**ENE**) component predominates with a percentage of 39.49%, followed by the predominant wind flow from the East (**E**) with 28.81% and in third position the Northeast (**NE**) direction with 11.57%, sum of these three wind directions amounting to a percentage of 79.88%. On the other hand, the remaining thirteen (13) radials of the wind rose shares the remaining 20.12%, that which do not modify the dominant tendency of the East/Northeast direction and distributed between values ranging from 6.065175% and 0.0915%, as can be seen in Graph N° 06.



**Graph N° 06 Wind Rose**  
Central Station IADC from the 13<sup>th</sup> May 06 to 12<sup>th</sup> July 08

The wind intensity in this period of evaluation, maintained an absolute maximum of 37 Kts and an average (of the daily extreme values) of 20.4 Kts, where you can see micro wind gusts registered by this automatic station of 41 Kts, particularly on the 22<sup>nd</sup> of August 2007 for a period of ten minutes from 13:21 to 13:30 hours, but it is also to note that the registered absolute maximum in these ten minutes oscillated between 9 and 18 Kts.

The reason for the presence of these micro wind gusts in the region is owing to the displacement of tropical disturbances (Tropical Storms and Hurricanes) and the passage of tropical waves in this oceanic zone.

Following are a series of graphs of the representation of the maximum and average wind intensities at the Central Station at IADC according to Graphs N° 07a, 07b, 07c, 07d, 07e, 07f, 07g, 07h, 07i, 07j, 07k, 07l, 07m, 07ñ, 07o, 07p and 07q.

## Picture of frequency of the intensity of the wind from the 12 of February 2007 to the 12 of July 2008 in Argyle projection of track 02/20.

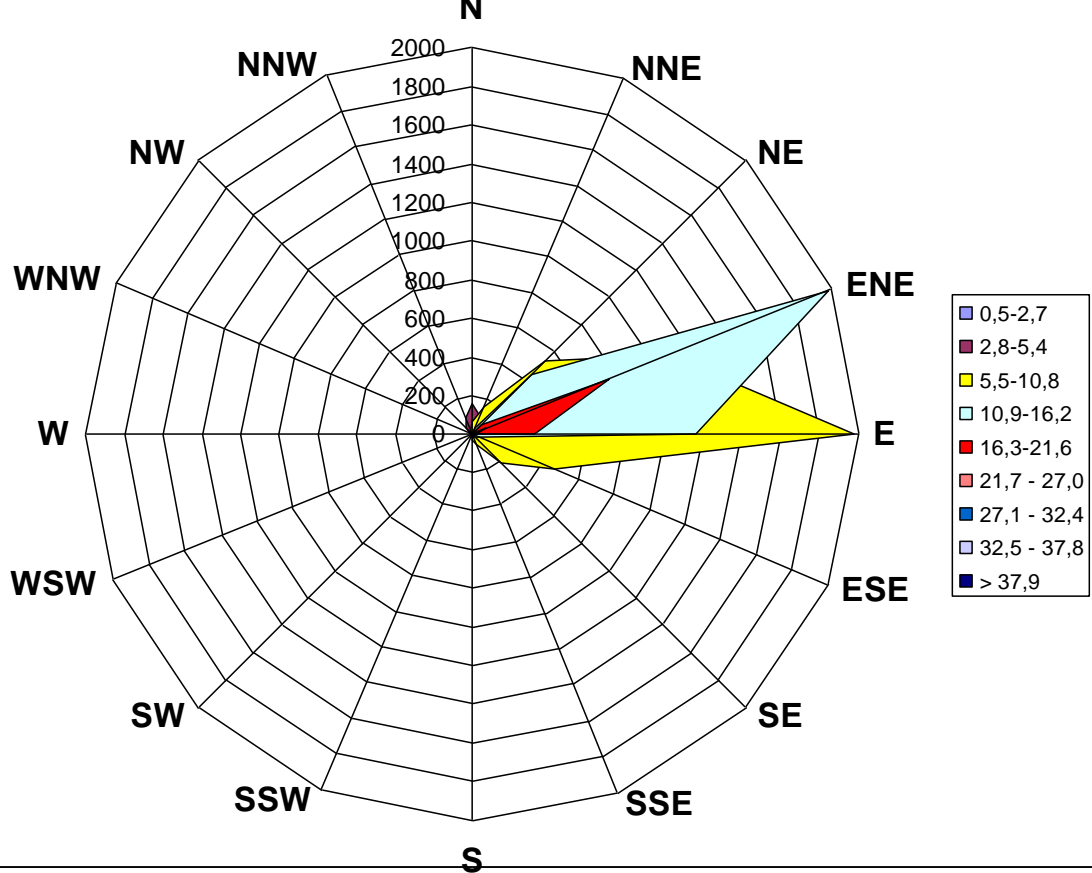
The present picture of frequency of the intensity of the wind, represents ten thousand seven hundred sixty and four (10.764) hours or data in studies of the automatic stations, as it is observed in the graph N° 08, that correspond to the evaluation of the intensity of the wind and classification of the intensities expressed in knots (Kts) from the 12 of February 2007 to the 12 of July 2008 with the purpose of knowing the magnitude incidences of the wind speed according to the 16 directions of the wind rose.

Based on the percentage information of the frequency of the intensity of winds in Argyle in the lapse of eighteen (18) months, one determines that the intensities of the flow of the wind are distributed in seven (07) scales expressed in knot (Kts). Next, the percentage on the basis of the contributed data (population) of the frequency of the intensity in agreement will be detailed with greater exactitude from where the flow of the wind according to the wind rose comes and as it is demonstrated in the demonstrative picture N° 04:

- The scale between 0.5 Kts and 2.7 Kts, the incidence of the wind intensity comes from the North (**N**) with 0.29%, followed by the North/Northwest (**NNW**) with 0.14%.
- The scale between 2.8 Kts and 5.4 Kts, the incidence of the wind intensity comes from the East (**E**) with 2.41%, followed by the North (**N**) with 1.43%.
- The scale between 5.5 Kts and 10.8 Kts, the incidence of the wind intensity comes from the East (**E**) with 18.36%, followed by the East/Northeast (**ENE**) with 10.17%.
- The scale between 10.9 Kts and 16.2 Kts, incidence of the wind intensity comes from the East/Northeast (**ENE**) with 18.44%, followed by the East (**E**) with 10.73%.
- The scale between 16.3 Kts and 21.6 Kts, the incidence of the wind intensity comes from the East/Northeast (**ENE**) with 7.13%, followed by the East (**E**) with 3.01%.
- The scale between 21.7 Kts and 27.0 Kts, the incidence of the wind intensity comes from the East/Northeast (**ENE**) with 0.76%, followed by the East (**E**) with 0.21% and finally
- The greater scale to 37 Kts, exists only one registered value from the East (**E**) with 0.009%.

It is to make notice that the intensities before analyzed, correspond to the data contributed hour like absolute value to the observation, where the originating wind speeds of the east (**E**) Kts predominates with but frequency between 2.8 until 10.8 Kts and the dominant flow of the northeast east/**ENE** the intensity between the scales of 10.9 27.0 Kts is but incident and Kts, in the same way are expressed that only a single contributed data, has exceeded the 39 Kts.

**FRECUENCIA DE LA INTENSIDAD DEL VIENTO (KTS) EN LA ESTACION CENTRAL IADC DESDE EL 12FEB2007 AL 12JUL 2008**



**Graph N° 08** Frequency of Wind Intensity in (Kts) in Argyle from the 12<sup>th</sup> Feb 07 to the 12<sup>th</sup> July 08

**CHART OF FREQUENCY OF WIND AT CENTRAL STATION IADC 12<sup>TH</sup> FEBRUARY 2007 TO 12<sup>TH</sup> JULY 2008**

		WIND INTENSITY IN KTS (KNOTS)								SUMA	TOTAL %	
		0,5-2,7	2,8-5,4	5,5-10,8	10,9-16,2	16,3-21,6	21,7-27,0	27,1-32,4	32,5-37,8			>37,9
<b>Calm</b>												
<b>N</b>		31	154	61							246	2,285396
<b>NNE</b>		11	103	155	32	3					304	2,824229
<b>NE</b>		8	87	537	433	73	1				1139	10,58157
<b>ENE</b>		9	70	1095	1985	767	82				4008	37,23523
<b>E</b>		13	259	1976	1155	324	23			1	3751	34,84764
<b>ESE</b>		5	130	462	44	2					643	5,973616
<b>SE</b>		5	85	212	23	5					330	3,065775
<b>SSE</b>		1	12	60	7						80	0,743218
<b>S</b>		2	17	29	5	2					55	0,510962
<b>SSW</b>		1	2		1	2					6	0,055741
<b>SW</b>		2	4		2						8	0,074322
<b>WSW</b>		3	1	1	1						6	0,055741
<b>W</b>		3	2								5	0,046451
<b>WNW</b>		5	8	1							14	0,130063
<b>NW</b>		6	38	1							45	0,41806
<b>NNW</b>		15	96	13							124	1,151988
<b>SUM</b>		120	1068	4603	3688	1178	106	0	0	1	10764	100

**Chart N° 04** Frequency of the Wind Intensity in Argyle from the 12<sup>th</sup> Feb 07 to 12<sup>th</sup> July 08

**Chart of maximum wind gusts at the IADC Station present in the region of Argyle during 2006 and 2007.**

<b>2007</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
		28 Kts	29 Kts	30 Kts	28 Kts	30 Kts	33 Kts	41 Kts	35 Kts	40 Kts	33 Kts	36 Kts
		11 min	10 min	16 min	10 min	10 min	11 min	10 min	10 min	10 min	10 min	10 min
		Morning	Early morning	Evening	Morning	Night	Morning & Evening	Evening & Night	Early morning	Early morning	Evening	Night
		<b>E</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>ENE</b>	<b>ENE</b>	<b>SE</b>	<b>ENE</b>	<b>W / WSW</b>	<b>ENE</b>	<b>ENE</b>
							<b>H. Dean</b>		<b>H. Felix</b>	<b>Noel</b>		
<b>2008</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
	31 Kts	33 Kts	40 Kts	33 Kts	30 Kts	34 Kts	26 Kts					
	10 min	10 min	10 min	10 min	10 min	10 min	8 min					
	Morning	Night	Morning	Morning	Morning	Early Morn	Night					
	<b>ENE</b>	<b>NE</b>	<b>E</b>	<b>E</b>	<b>E/ESE</b>	<b>NE</b>	<b>ENE</b>					

**Note:**

Micro Wind Gusts of maximum that have appeared in the different months, obey to determining meteorological factors like the presents as of the month of July until November by the displacements of tropical waves and tropical revolving storms in the Caribbean, which inestabilizan or modify the pattern of the wind in the different layers from the troposphere in the region

**General recommendations:**

- The continuity of the studies of winds in the region of Argyle is recommended, with the purpose of the fortification of the data collected at the moment.
- The hiring of a company specialized in maintenance of equipment or automatic stations minimum two (02) times to the year or when they require the transfer of the stations from a site to another one and at the same time to guarantee the good operation of the different sensors and electrical equipment.
- Of he himself way the covering of the metallic parts of the antennas with anticorrosive paintings and to prevent the corrosion product with the marine saltpeter and to maintain lubrications winches of the antennas.
- To consider before the month of September the change of the automatic station of head 020 for its new location the Ing. Aluko Dublín encuesta of the new site of transfer.

**MT1.(AVB) DIOGENES CARRILLO TIRADO  
ESPECIALISTA EN METEOROLOGIA AERONAUTICA**

**MSC. LEONARDO PÉREZ PÉREZ  
COORDINADOR DE LA COMISIÓN  
AEROPUERTO INTERNACIONAL ARGYLE**