



An interactive Video Conference  
for KS2 to KS5 provided by the  
National Space Centre



**Team Instructions for the  
Emergency Response Unit:**

Volcano Team  
Hurricane Team  
Evacuation Team  
Satellite Team  
Communications Team

# VOLCANO TEAM INSTRUCTIONS

YOU WILL NEED :

VOLCANO WORKSHEET  
VOLCANO GRAPHS  
VOLCANO REPORT FORMS

THESE CAN BE FOUND AT:

<http://vc.spacecentre.co.uk/teacher/preMissionPrep/teamMaterials.htm>

1. DOWNLOAD THE REAL TIME DATA - Mission Control will give you the web address to receive the real time data from the volcano. Copy this data into the tables on your worksheets.

2. CALCULATE CUMULATIVE DATA

The cumulative data (either **RF** or **VT**) is the total number (the addition of the **Hourly RF** or **Hourly VT**) recorded so far in the mission. The data you receive for **RF** and **VT** are for that hour and that hour only.

**Write down** these values in the tables in column C.

## EXAMPLE RF DATA (VT DATA TABLE IS SIMILAR)

A	B	C	D	E	F
GMT Hours	Hourly RF (from real-time data)	Cumulative RF	Multiply By	Predicted Daily RF Total	Predicted Total Seismic Activity (RF + VT)
00:00	4	4	24	96	384
01:00	16	20	12	240	456

16+4=Cumulative RF

2

20x12 = Predicted Daily RF Total

3. CALCULATE PREDICTED DAILY TOTALS

*Multiply* the cumulative data (**RF** or **VT**) in column C by the number in column D. *Record* these values in column E.

(Note: the number in column D is derived by dividing 24 by the number of hours of data received so far - this means that in the first hour the multiplier is  $(24/1 = 24)$ , in the second hour it is  $(24/2 = 12)$ , third hour  $(24/3 = 8)$ , fourth hour  $(24/4 = 6)$  and so on.)

4. CALCULATE THE PREDICTED TOTAL SEISMIC ACTIVITY- (TSA)


*Add* the Predicted Daily VT total (column E) and the Predicted Daily RF total (column E) together. *Record* this in column F.

5. REPORT VOLCANO DATA TO THE DATA TEAM -

*Record* the relevant data onto the Volcano Team report form and deliver this *immediately* to your **Data Team**. They need this data from you to keep mission control and the residents of Montserrat informed.

Report Form: Volcano Team

VT = Volcanic Tremors  
RF = Rock Fall



GMT Hours	Hourly VT (from real-time data)	Cumulative Hourly VT	Predicted Daily VT Total	
	Hourly RF (from real-time data)	Cumulative Hourly RF	Predicted Daily RF Total	Predicted Total Seismic Activity (RF + VT)

6. GRAPH THE VOLCANIC DATA

*Plot* three separate line graphs:- RF vs. time, VT vs. Time and also TSA vs. time (all time should be GMT). This will give you an overview of the behaviour of the volcano.

For *all three* graphs the x-axis should be GMT from 00.00 hrs - 23.00 hrs.

For the VT and RF graph the y-axis should be numbered from 0 - 60.

For the TSA graph the y-axis should be numbered from 500 - 1200.

**Repeat steps 1-6 for each hour of data that you receive.**

**Remember**

A large increase in Volcanic Tremors or Rock Fall between one reading and the next could mean **pyroclastic** or **lava flows** may occur soon.

A large increase in TSA between one reading and the next could mean the volcano might erupt soon.

# Hurricane Team Instructions

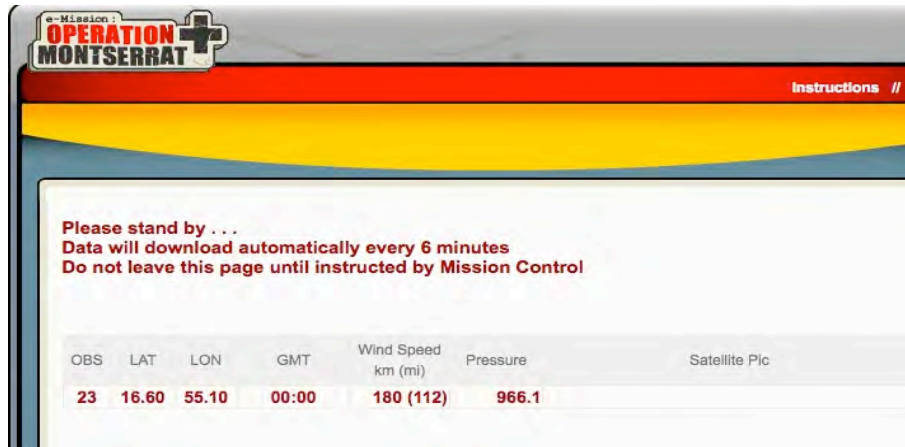
YOU WILL NEED:

- Hurricane worksheet
- Hurricane tracking map
- Hurricane Report Forms

THESE CAN BE FOUND AT:-

<http://vc.spacecentre.co.uk/teacher/preMissionPrep/teamMaterials.htm>

You will also need a Calculator, Ruler and a Compass



This is the real data you will receive every **6 mins from the website.**

This information will then need to be put into your hurricane tracking worksheet. Using the following steps: (practice data only is shown in the example below)

	A	B	C	D	E	F	G	H	I	J	K	L
	OBS	Lat. North	Lon. West	Time GMT	Wind kph* (mph)	Pressure (mbar)	Saffir-Simpson Hurricane Scale	Distance travelled km (mi)	Speed kph (mph)	Direction of Hurr.	Distance to Island km (mi)	ETA Montserrat (Hours till arrival.)
Practice Data	21	16 5	54 8	03 Sept 21 00	77 (48)	996	Hurricane 1	n/a	n/a	n/a	540(335)	n/a
	22	16 5	54 9	03 Sept 22 30	100 (63)	978	Hurricane 1	10 (6)	7 (4)	W	530 (330)	76

COLUMNS A - F

- Fill in the latitude (LAT. north) in column B
- Fill in the longitude (LON. west) in column C
- Fill in time GMT in column D
- Fill in wind speed in both kph and mph in column E
- Fill in pressure in column F

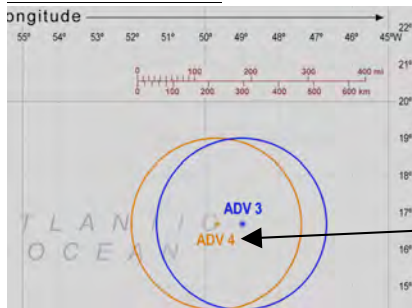
COLUMN G:

To work out the scale of the hurricane use the Saffir-Simpson Hurricane scale at the bottom of the Hurricane tracking worksheet.

Winds	Category	Severity
Less Than 118 kph (74 mph)	Tropical Storm	very weak
119-152 kph (74-95 mph)	<b>1</b>	weak
153-177 kph (96-110 mph)	<b>2</b>	moderate
178-209 kph (111-130 mph)	<b>3</b>	strong
210-248 kph (131-155 mph)	<b>4</b>	very strong
above 248 kph (155 mph)	<b>5</b>	devastating

Be careful to use only kph or mph when reading off wind speed for category and severity of Hurricane Bob

PLOT THE HURRICANE'S POSITION ON THE HURRICANE TRACKING MAP USING COORDINATES FROM COLUMN B AND C.



First, mark a CROSS (X) on the map where the coordinates for the longitude and latitude cross. This is the **Eye** of the storm. (Use the coordinates from **column B and C** of the table).

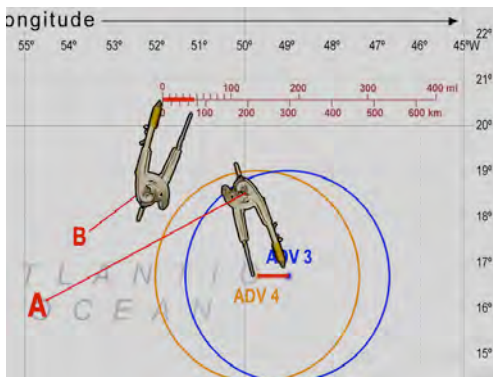
Mark cross at this point

Using a compass, draw a circle with a radius of **240km** - (Hurricane Bob has a diameter of 480km).

Use the CROSS you have just made as the centre point and set your compass to the right size, using the scale at the top of the map.

Once you receive a second set of coordinates you can plot a second CROSS to show where the eye of the storm has moved to within the past 90 minutes

Keeping the compass set for 240km draw the current position of the hurricane.



COLUMN H: DISTANCE TRAVELLED.

To do this, measure the distance between where the eye of the storm *was* and where it has moved to (A).

Use the scale at the top of the map (B) work out the answer in km, or miles, and enter this into column H

COLUMN I: SPEED To calculate the speed of the hurricane you will need to use the formula:

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

Using the answer in **column H** as the distance, divide this by the time taken to move this distance in hours. (*remember it is 90 minutes between each reading*)

**For example:**

if we take the difference in time between obs 22 (22:30) and obs 21 (21:00):

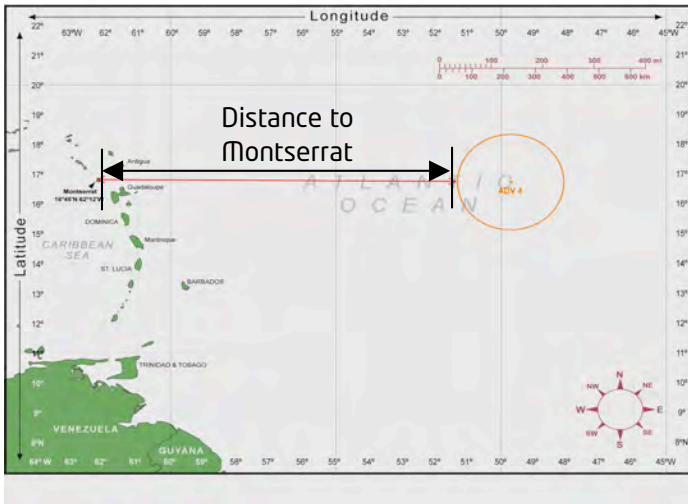
$$\text{obs 22} - \text{obs 21} = 1.5 \text{ hours (90 minutes)}$$

Then input the distance and time into the above formula and this will give you the answer for **column I**

Using the navigational compass, at the bottom corner of the map, determine the direction of the hurricane. Be as accurate as possible using N, NW, NE, S, SW, SE, E, W when necessary.

This is your answer to **column J**

COLUMN K DISTANCE TO ISLAND.



Measure the distance from the leading edge of the storm to the island.

(Not from the eye of the storm, but from the outer edge of the circle you marked on the map to show the radius)

Using the scale at the top of the map work out the distance in km.

COLUMN L: ETA (ESTIMATED TIME OF ARRIVAL AT MONTSERRAT)

To work out the estimated time of arrival or ETA, divide the distance to the island from **column k** by the speed in **column I** this will give you the ETA for **column L**.

**Now practice with the archive data below**

A	B	C	D	E	F	G	H	I	J	K	L
OBS	Lat. North	Lon. West	Time GMT	Wind kph*	Pressure (mbar)	Saffir-Simpson Hurricane Scale	Distance travelled km	Speed kph	Direction of Hurr.	Distance to Island km	ETA Montserrat (Hours till arrival.)
21	16.5	54.8	03Sept 21 00	77	996						
22	16.5	54.9	03Sept 22 30	100	978						



### YOU WILL NEED:

A4 or A3 Maps of the Island showing the towns, roads, population and the volcano

THESE CAN BE FOUND AT:

<http://vc.spacecentre.co.uk/teacher/preMissionPrep/teamMaterials.htm>

YOU WILL ALSO NEED - Pens/pencils          Paper for notes

The evacuation team are responsible for evacuating the residents away from the hazards on the island of Montserrat.

### BACKGROUND INFORMATION AND EVACUATION

#### YESTERDAY

Soufriere Hills volcanic activity is making Montserrat a very dangerous place. The official danger zone includes the area from Broderick's Estate, south to Old Fort Point and all areas south of the Aymer's Ghaut River. On Sept 3<sup>d</sup>, these areas were completely evacuated. That places more pressure on the housing and shelters in the north of the island.

The volcanic activity now threatens all areas flanking the volcano, including some areas surrounding the Belham River Valley.

The British and the local government are encouraging voluntary, off-island evacuation. Evacuees will receive financial assistance. Details will come later in the week. Evacuees will first go to Antigua then to the United Kingdom or other Caribbean Islands. Teams of emergency workers have been formed including members from the police, immigration, customs, Red Cross, and the National Office of Disaster Services. Nurses sent to Montserrat last week from Grenada and St. Lucia are safe and are being kept updated.

#### TODAY

Hurricane Bob is bearing down on the island. The eye of the storm is 460 miles away, travelling west at 10 miles per hour. The storm rotates around the central eye forming a circle with a radius of 150 miles. Expected time of arrival is less than 48 hours. The hurricane is currently a category 3, with wind speeds steady at 120 mph and gusts of up to 160 mph. Storm surge waves are 4 metres high. All ports are closed; boats and airplanes have been halted.

Today the volcano at Soufrière Hills has shown seismic activity nearly three times previous levels in the last few weeks. Scientists expect it could erupt explosively at any time. Small lava/mud flows have been sighted on the east side of the island in the Tar River Valley. Ash plumes and raining ash are constant and are creating difficulties for visibility, driving and breathing.



# Communications Team Instructions

## THE MISSION

Communications team you will handle all the communications between the Emergency Response Team and Mission Control. You must make sure that all instructions from Mission Control are understood.

Your team needs to have people in charge of the following tasks:

**Comm. Officer.** Select one spokesperson who uses the microphone and sits in sight of the camera to communicate with Mission Control.

**Data Officer.** Select one person to type all team reports and other messages into a chat/data window. The Data Officer should be able to type well.

## YOUR TASK

- You must make sure there is a steady flow of information from each team to Mission Control, and from Mission Control back to each team.

Reports (written and spoken) should be relayed every 5 -6 minutes. If a team does not send reports regularly it is your responsibility to go and get them from the team to send to Mission Control.

## MISSION PREPARATION

- You can use post-it notes so that you know which team the message is from or to. You could use another colour if the message is very important.
- Make sure each team has **report forms** and uses them to write their data reports clearly.
- Make sure there is somebody on each team who will be the representative if Mission Control asks to talk to the team directly. Tell the team representative how to communicate with Mission Control if and when they need to.

## TIPS

- All communication should be spoken first over the microphone and then typed into the chat window.

The URL for the chat/data window is:

<http://vc.spacecentre.co.uk/omdata>





# Satellite Team Instructions

**YOU WILL NEED:**

- Satellite Team Worksheet
- Observations tracking map A4
- Satellite tracking map A4

**THESE CAN BE FOUND AT:**

<http://vc.spacecentre.co.uk/teacher/preMissionPrep/teamMaterials.htm>

You will also need a calculator, clear ruler, compass and a pencil

**Satellite Data**  
Send instruction to currently selected satellite to make observation.

Time  
e.g. 09:11:32 GMT    **hr mn sec**  
   **07 : : : GMT**

Frequency  
e.g. 167.5 GHz    **----** **GHz**

**SEND**

**Satellite Response Line**

Latitude (deg.)   

Longitude (deg.)   

**Satellite Data**

OBS	GMT	Latitude (degrees)	Longitude (degrees)	Heading (N/S)	Wavelength (metres)
7	7:00	25.3 N	61.6 W	S	0.0017377
6	6:00	15.1 S	60.0 W	N	0.0017908

(Fig 1)

Above (Fig. 1) is the layout of the data stream, you will be receiving every 5 minutes during the mission.

This information will then need to be written on the satellite tracking sheet. (see Fig.2)

Enter information from the screen into the tracking sheet as shown below:  
Column B - enter the GMT time

- Column C** - enter the latitude in degrees and either North or South direction
- Column D** - enter the longitude in degrees and either East or West in direction.
- Column E** - enter the heading direction of the satellite either North or South.
- Column F** - enter the wavelength in meters.

**Satellite Tracking Data Sheet  
(Fig 2)**

A	B	C		D		E	F	G		H	I	J
OBS	Time	Latitude		Longitude		Heading	Wavelength	Time to Target		Observation Time	Frequency	Successful Scan
	GMT	Deg	N/S	Deg	E/W	(N/S)	(m)	Min.	Sec.		GMT	Y/N
1												
2												
3												
4												

Plot the longitude and latitude of the satellite on the *Satellite Tracking Map* with a small cross.

Next to the cross, write the observation time so you can keep track of the satellite.

COLUMN G TIME TO TARGET:

Lay a ruler horizontally across the map, where you have marked the cross. Now read off the edge of the map, the time in minutes and seconds. This is the time to target.

**Be careful when reading the time on the edge of the map as zero is in the middle at the latitude of the *Island of Montserrat* and the time runs both north and south directions.**

COLUMN H OBSERVATION TIME:

Add together the time to target (in minutes and seconds) from column G together with the GMT time (in hours) recorded in column B. This will give you the observation time needed (in hours/minutes/seconds) for the satellite in column H.

COLUMN I FREQUENCY:

To calculate the frequency on which the satellite needs to transmit you will need to divide 0.3 by the wavelength recorded in **column F**. This will need to be rounded to one decimal place.

(Note: this is a determination of frequency using the formula  $v = f\lambda$  where the speed of light  $v$  is equal to the frequency  $f$  multiplied by the wavelength ( $\lambda$ ). To make this a simple calculation the speed of light is taken as a value of 0.3 and dividing this by the wavelength given in metres (0.00XXXX) ensures a resultant number in the region of 160~180 GHz)

DURING THE MISSION ONLY:

Enter the calculated observation time and the frequency on the web page in the boxes provided and press the send button. (see fig. 1)

**To check that satellite has recorded accurate information about the Island of Montserrat:**

The satellite will return data about the pass on the right hand side of the screen under Satellite Response Line giving a further latitude and longitude. Using this new longitude and latitude plot a cross on the *Observation Tracking Map*.

With this cross as the central point draw a circle with a radius of 80km. (*use the scale at the bottom corner of the map to set your compass to the correct radius*) This is then the area covered by the satellite on its pass - which should have the Island of Montserrat somewhere within the circle

If the Island of Montserrat does lie within the circle then the satellite will have been successful in receiving data. If not the satellite has been unsuccessful this time. Make a note in column J as to whether the satellite pass was successful or not.

**Make sure you inform the communications officer whether the pass has been successful or not.**