**2011 Booth Invitational Science Olympiad Tournament**

**Compute This!**

**Background**

 The National Oceanic and Atmospheric Administration (NOAA) maintains six different types of aircraft to support the environmental mission of the agency. The aircraft are equipped with sophisticated scientific instrumentation to fulfill their role in monitoring hurricanes and other severe storms, providing vertical atmospheric soundings, determining the quality of the atmosphere, studying climate trends, and performing aerial snow survey operations. The aircraft have all been certified by the FAA for an empty weight and for the max. gross weight (which includes fuel, passengers, cargo, and additional equipment).

**Graphical Problem**

Please follow the instructions exactly. You may use any search engine to find the information, but all answers must be found within the NOAA domain.

Using a web browser, for each of the six aircraft, find the aircraft type, the empty weight (EW), and the max gross weight (MGW) at takeoff. If only one value for MGW is listed, assume that value to be the takeoff value. Create a data table and label the first column as “Aircraft Type”, the second column as “Empty Weight”, the third Column as “Useful Load”, and the fourth column as “Max. Gross Weight”. Record the aircraft type (use an abbreviation), EW and MGW of each aircraft in the appropriate column. Then, use a spreadsheet formula to calculate the useful load of each aircraft in the appropriate column. The useful load is calculated by subtracting the empty weight from the MGW. Note: Useful load must be calculated. DO NOT use the values listed on tables found on the NOAA website. Finally, rearrange aircraft in the chart from the lowest to highest EW.

In a spreadsheet, create a stacked columns graph and place it neatly below your data table. The stacked column should represent the EW in one color and the Useful Load in another color for each of the aircraft types. On the same graph and axis, create a line graph for the MGW data using the following instructions: Using the data “Series Max Gross Weight” change the chart type to line with markers. Since the MGW is NOT a continuous function between each of the different aircraft types, the following changes need to be made to the data series: Format the line color to “no line” and use a marker symbol of a diamond to represent the MGW. For clarity, include data labels for the value of MGW above each diamond. Label the x-axis as Aircraft Type, the y-axis as Weight (lbs), and rotate the aircraft type labels 90 degrees counter-clockwise. Ensure the legend for Useful Load, EW, and MGW is visible on the right side and create your own title for the graph. Finally, expand the graph so that all portions (including labels) are clearly visible.

**Short Answer Questions**

In a word processing document, please provide the answer and associated URL for each of the following questions. Official **noaa.gov** web sites should be referenced.  Please note that each question requires two separate answers and complete sentences are NOT required.

1. NOAA’s Hurricane Hunter aircraft are the primary platforms for meteorological research. What “named” infamous Atlantic storm struck Dade County, Florida in August 1992?  According to the Preliminary Report, what was the estimated cost of damage in dollars?

2. “Miss Piggy”, “Kermit”, and “Gonzo” are the nicknames for the latest aircraft in an impressive line of U.S.-based hurricane research aircraft. Who was the first director of the National Hurricane Research Project (NHRP)? On what date was the first NHRP flight?

3. To forecast the amount of spring flooding in the U.S., NOAA aircraft make winter flights over the snow pack to record the amount of ground snow. The snow totals are converted to their equivalent water amounts. What is the name of the Sensing Center that is responsible for these airborne Snow Water Equivalent (SWE) measurements? Airborne SWE measurements are conducted by NOAA aircraft in flight lines that are typically 16 km long and 300 m wide. What is the approximate area covered by one flight line?

4. NOAA’s aircraft support the Air Resources Lab by measuring eddy fluxes and concentration gradients through the atmospheric mixed layer. In what four fields does NOAA’s Air Resources Laboratory (ARL) conduct research and development? How many stations conduct intensive urban research as part of the DCNet meteorological network within the National Capital Region?

5. National Severe Storms Laboratory (NSSL) high winds research projects like the Verification of the Origins of Rotation in Tornadoes Experiment (VORTEX) have been supported by NOAA aircraft. NSSL focuses on severe weather processes, and developing weather observation technology, with emphasis on what 3 areas? According to NSSL, what are the seven types of damaging winds?

**General Instructions**

1. Please place your school name and team number at the top of your word processing and spreadsheet documents.

2. Please name your text file (school name).odt and your spreadsheet file (school name).ods. Save your work regularly as instructed.

3. Your spreadsheet file should include both a data table and a stacked columns graph as described above. Your document file needs to include the answers and URLs for each of the five questions.

4. Reference materials and calculators are not permitted. You may use blank scrap paper to organize your work.

5. This is a two-person event. Absolutely no external communication with others (e-mail, chat, forums, etc.).

6. Please raise your hand if you have a technical problem or question on the event.

7. Please speak in a low tone with your partner. Let’s keep the noise level down.

8. When you are done, please save your files as instructed by the proctor.

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**SOLUTION**

1. Hurricane Andrew, $25 billion

http://www.nhc.**noaa.gov**/1992andrew.html

2. Dr. Robert H. Simpson, August 13, 1956

[http://www.aoml.**noaa.gov**/hrd/hist/](http://www.aoml.noaa.gov/hrd/hist/)

3. National Operational Hydrologic Remote Sensing Center (NOHRSC), 5 sq. km (NOTE: must have “Sq. or “Square” in the answer)

[http://aprfc.arh.**noaa.gov**/resources/docs/gammaswe.php](http://aprfc.arh.noaa.gov/resources/docs/gammaswe.php)

4. air quality, atmospheric dispersion, climate, boundary layer science, 15 stations

[http://www.arl.**noaa.gov**/](http://www.arl.noaa.gov/)

http://www.arl.**noaa.gov**/dcnet.php

5. weather radar, hydrometeorology, forecast & warning improvements

straight-line winds, downdrafts, downbursts, microbursts, gust front, derecho, and bow echo

http://www.nssl.**noaa.gov**/

[http://www.nssl.**noaa.gov**/primer/wind/wind\_basics.html](http://www.nssl.noaa.gov/primer/wind/wind_basics.html)

**NOTE: URL's may vary from above, but should include noaa.gov somewhere in the URL**

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**Compute This!**

**SOLUTION**

|  |  |  |  |
| --- | --- | --- | --- |
| NOAA Aircraft Weight Information | | | |
| Aircraft Type | Empty Weight (EW) (lbs) | Useful Load | Max Gross Weight (MGW) (lbs) |
| AC-500S | 5341 | 1409 | 6750 |
| 695-A | 7300 | 3950 | 11250 |
| DHC-6 | 8100 | 4400 | 12500 |
| 350 CER | 10300 | 6200 | 16500 |
| IV-SP | 43700 | 30900 | 74600 |
| WP-30 | 73000 | 62000 | 135000 |

**NOTES:** All values must be exactly as recorded in the table above. The aircraft type can be abbreviated. Look for variations that include any of the following information.

|  |  |
| --- | --- |
| AC-500S | RockwellAero Commander (AC-500S) |
| 695-A | Gulfstream Jet Prop Commander 1000 (695A) |
| DHC-6 | DeHavilland Twin Otter (DHC-6) |
| 350 CER | Hawker Beechcraft King Air 350CER (Silver Vintage) |
| IV-SP | Gulfstream IV-SP (G-IV) |
| WP-30 | Lockheed WP-3D Orion |

**NOTES:** Aircraft type must be in the order shown. The columns must be stacked (empty weight on bottom, useful load on top) and the max gross weight must be represented by a diamond with a label above. Title may vary, but should indicate aircraft and weight.

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**SCHOOL NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ TEAM NUMBER \_\_\_\_\_\_\_\_\_\_\_**

**STUDENT NAMES (printed) 1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**(Do Not Write Below This Line – Event Supervisor Use Only)**

**PLACE\_\_\_\_\_\_\_\_\_\_\_**

**Completeness & Accuracy of Quantitative Data Collected (20 Points Max) \_\_\_\_\_\_**

(Subtract 1 point for each wrong answer in each category up to maximum points)

Aircraft Type \_\_\_\_\_ (5 points)

Empty Weight \_\_\_\_\_ (5 points)

Useful Load \_\_\_\_\_ (5 points)

Max Gross Weight \_\_\_\_\_ (5 points)

**Completeness, Accuracy, and Format of Graphical Data (30 Points Max) \_\_\_\_\_\_**

Stacked Columns Format \_\_\_\_\_ (6 points – 2x3)

(stacked EW bottom/UL top, order correct)

Title Above Graph \_\_\_\_\_ (5 points)

X-Axis and Y-Axis Labeled \_\_\_\_\_ (4 points – 2x2)

Max Gross Weight \_\_\_\_\_ (5 points)

(diamond icon and data labeled with no continuous line on graph)

Legend on Right with Labels \_\_\_\_\_ (5 points)

Aircraft type is rotated 90 degrees CCW \_\_\_\_\_ (5 points)

**Answers and URLs for Short Answer Questions (50 Points Max) \_\_\_\_\_\_**

1. Storm name, Damage in Dollars \_\_\_\_\_ (10 points – 5x2)

2. Director name, Date of Flight \_\_\_\_\_ (10 points – 5x2)

3. Center name, Area (with units) \_\_\_\_\_ (10 points – 5x2)

4. Four Fields, Number of Stations \_\_\_\_\_ (10 points – 2x5)

5. NSSL Areas, Wind Types \_\_\_\_\_ (10 points – 1x10)

**TOTAL SCORE** \_\_\_\_\_\_

**TIE BREAKER: [ ] Short Answer Questions [ ] Quantitative Data Collected [ ] Overall Graphical Quality**