Missions for America
Semper vigilans!
Semper volans!

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15-17 SEP-CTWG Conference
21-24 SEP-Durham Fair Parking Detail
23 SEP-Scarecrow Festival-Preston
04 NOV-Col Palmer Cadet Ball

FRUIT SALE FUNDRAISER COMMENCES

This is the second week of the citrus fruit fundraiser. Fight both scurvy and squadron bankruptcy by selling navel oranges and grapefruit.

Low Hanging Fruit

CADET MEETING

12 September, 2023
submitted by
Capt Steven Deignan-Schmidt

Tonight's cadet meeting consisted of drill practice, raising and retiring of the colors, and a viewing of Randy Pausch's Last Lecture.

Prof. Randy Pausch was a professor of virtual reality at Carnegie-Mellon. He delivered a last lecture after being diagnosed with terminal cancer in 2008. The lecture, entitled 'Achieving your childhood dreams' provides guidance on leadership and how to live a successful life.

SENIOR MEETING

12 September, 2023

Capt Jason Otrin presented a well constructed and informative briefing on hurricane preparedness which focused on what the squadron ought consider when faced with a major storm striking Connecticut. A round table discussion followed in which officers related past experiences, lessons learned and opined about the complex issues involving manpower, transportation, equipment damage and infrastructure damage which must be considered.

AEROSPACE CHRONOLOGY

13 September 1935: Flying his Hughes H-1 Special, NR258Y, Howard Hughes set a *Fédération Aéronautique Internationale* (FAI) World Record for Speed Over a 3 Kilometer Course. He made the required repeated passes in two directions and averaged 352.39 mph, 38 mph faster that the previous record.

As he completed his final pass, the engine stopped due to fuel starvation. The aircraft had been prepared with enough fuel for six passes but an imprudent Hughes pushed for one more and had to belly-landed the plane in a beet field escaping with little damage except a beat-up prop.

Sept. 14, 1941– The first British escort carrier, *HMS Audacity,* set sail on its first combat mission, escorting a convoy bound for Gibraltar.

Audacity and Martlets

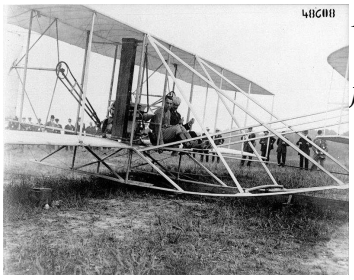
She carried eight Martlets, the British name for the Grumman Wildcat and one of the pilots was Eric "Winkle" Brown, who would later achieve fame as, arguably, the greatest test pilot in history.

Sept. 15, 1942- A Vultee XA-31A Vengeance, a re-designated prototype, piloted by H. H. Sargent Jr. out of Rentschler Field, Connecticut, overturns in a Windsor Locks, Connecticut tobacco field while making a forced landing.

Known as the A-31 in U.S. service, the aircraft was probably being used as an engine testbed by Pratt & Whitney.

Sept 16, 1910 – Bessica Raiche makes the first solo airplane flight by a woman in the United States. She made the flight in a bamboo and silk copy of a Wright style aircraft which she and her husband built in their living room. She was a practicing physician and competent linguist.

Sept. 17, 1908 – Wright Model A, Army Signal Corps serial number 1, piloted by Orville Wright Army Signal Corps serial number *1*, has a structural failure when a propeller cuts a control wire. Lt. Thomas E. Selfridge is killed, the first fatality in a heavier than air powered aircraft. Wright is seriously injured but recovered.



Before the fatal flight. Sefridge suffered a fractured skull, Wright had a broken leg, broken ribs, and a broken hip.
(Credit: National Museum of Health and Medicine)

Sept 18, 1984 – Joe Kittinger makes the first solo transatlantic balloon flight lifting of from from Caribou, Maine on September 14 and landing in Savona, Italy. He flew a Yost GB55 helium balloon name *Rosie O'Grady's Balloon of Peace.*

FEATURE ARTICLE

The original article was published, c. 2000, for a Massachusetts Institute of Technology organization promoting good teaching. The series suggested articles and books which provided enrichment material outside of the range of standard textbooks.

Hurricane
by
Stephen M. Rocketto

I can trace my fascination with hurricanes to 1954. The 1950's was a good decade for Atlantic hurricanes. In 1950, Atlantic hurricanes first received names using the military's phonetic alphabet: "Able, Baker, Charlie...." Three years later, the weather mavens switched to the use of female names. This new practice may have been suggested by George R. Stewart's 1941 novel, *Storm*, in which a meteorologist uses the name "Maria" to denominate a storm. During 1953 and 1954, a standard list of female names, "Alice, Barbara, Carol...", were used but in 1955, fearing confusion between storms in different years, six sets of names were established, to be repeated every six years. Names of notorious storms would be retired. This system stayed in effect until 1979 when men's names were alternated with women's names. At present, the World Meteorological Organization's Western Hemisphere Hurricane Committee follow this procedure with the addition of names in French and Spanish since these languages are used in the North American regions oft threatened by hurricanes.

However, the early '50s were not a good period for New England. In the previous half century, only one major hurricane had struck the northeast, the legendary Hurricane of 1938. However, in 1954, Carol and Edna plowed into New England and in 1955, Connie and Diane caused massive flooding. These were some of the deadliest and most costly storms to ever strike. Diane was the first hurricane to cause a billion dollars worth of damage. Deaths caused by the four storms combined exceeded 200 souls. The probability of a major hurricane striking the Long Island Sound region is about twice per hundred years. Now, four had struck in a two year period. The death tolls cannot compare to the 8,000 to 12,00 who died in Galveston, Texas in 1900 but it was a different time, the federal government took note, and a new era in hurricane research was financed by a nervous Congress, spearheaded by Senator Francis Green of Rhode Island.

At the time, most of this fascinating detail was not known to me, an 12 year old boy, with not an inkling of his own finitude and mortality. But as the summer of 1954 waned and the specter of school loomed, I followed the newspaper accounts in our local paper, *The New London Evening Day* detailing the approach of Hurricane Carol. As the storm moved closer, old timers reminisced about their 1938 experiences and accounts of that infamous storm were published in the local papers. Preparations were made. Boats were moved or double moored. Aircraft were flown inland. Homes fronting the sea had their windows boarded, water was stored in jugs and tubs, and not a loaf or bread, quart of milk, or egg were available from New Haven to Point Judith as people stocked their larders for the coming crisis.

If I went out on the roof of our back porch, I could, through a gap between the trees and houses, see the storm warning flags at the Coast Guard Moorings at Fort Trumbull. The small craft pennant was successively replaced by various gale warnings and I anxiously awaited the appearance of the pair of square red flags with square black centers that announced a hurricane. I had read that you could actually lean into the 64 kt winds of a hurricane and not fall over. I had also read about the huge waves generated by such a storm and what 12 year old boy could resist such a tempting surf. I had a date with a capricious lady named Carol.

My cunning mind knew that my mother would not go along with my plan to front nature's fury. Heck, she did not even like it if I wanted to gambol in a summer rain shower. The expedition had to be covert. I told her that I would make my storm headquarters in my room and follow the events on my old Hallicrafter shortwave. As the

storm moved towards maximum intensity, I made my move. My mother was occupied with housewifely duties and the CBS radio soap operas as I slipped out the front door. I couldn't don my slicker and galoshes since they were kept in the back hall and she would see me so I just had my summer garments and my Brooklyn Dodger baseball hat for protection from the elements. The cold wind driven rain lashed at me as I made my way down the hill, across Caulkins Park and the New York, New Haven, and Hartford railroad lines to the waterfront along Pequot Avenue.

What a sight! The storm surge, 10-15 feet, has pushed the water up and over the Thames embankments and the street was flooded. Large boats, had been driven over the street and were now aground on the inland side. Piers were smashed and the strand of Green's Harbor Beach was submerged. I was impressed. Now I knew there was danger afoot. Mostly, I was worried about fallen electrical wires because my failed boyish experiments with electricity had already taught me about the invisible dangers of household current. What I did not ken was that rain was not the only substance which the wind drove through the air.

At that point, I noted that various solid objects, tree branches, the components of boats, and household construction materials also seemed to be airborne. Mother Rocketto did not raise a complete fool. I beat a hasty retreat along my original path.

Reaching home, I peered through a window and noted that my mother was still in the living room with my younger brother and sister, knitting and listening to the portable radio. Power had now been lost. Shivering from the cold and from fear of discovery, I surreptitiously entered the house and silently crept up the stairs to my room, utilizing all of the skills of stalking which I had learned in Cub Scouts. I quickly stripped my sodden garments and donned dry clothes. Unfortunately, for some reason, my mother had made a round of the house and noticed the trail of water which I had left from the front door, up the steps, and directly into my room. She was most unhappy with me. My punishment was extreme. She didn't even yell at me but just gave me that "I am disappointed with you maternal look" which mothers have mastered through the ages. And since I couldn't be trusted alone in my room, I had to sit in the living room with her, my younger brother and baby sister, help her wind yarn, listen to soap operas like "The Romance of Helen Trent" and "My Gal Sunday" and wait for my father to get home. What is worse, I realized that in my excitement, I had forgot to lean into the wind and see if it would support me against the force of gravity.

Today, older and more prudent, I eschew wandering about in hurricanes without my slicker and galoshes. And I have amassed a rich trove of second hand hurricane experiences by reading about them. One of the best general texts about hurricanes is the *Hurricane Watch: Forecasting the Deadliest Storms on Earth* by Dr. Bob Sheets and Jack Williams. Dr. Sheets is the former director of the National Hurricane Center in Miami and Jack Williams is the founding editor of the *USA Today Weather Page*. Both have long experience in tropical meteorology and communications and their book is a compendium of the history and current status of hurricane prediction. I particularly enjoyed their chapters on hurricane prediction models, the practical application of models to study Hurricane Floyd, and the future of hurricane predictions.

The mathematical prediction of weather phenomena is hampered by a number of factors. These include coarse resolution of the data field, the difficulty in acquiring data, more equations, I believe, than known variables, lack of sufficient computer power, and the fact that turbulence is once of the most complex problems in modern science. A noted specialist in quantum mechanics was once asked why he took up the problems of subatomic particles. He replied that the study of turbulence was too difficult. In the early days, pioneers like Irving Krick relied on statistical studies of past weather to make long term predictions. On the assumption that the future will resemble the past, they assembled data bases of past weather and tried to match the current situation to a similar one in the past. To a certain

extent, this works. Warmer weather follows cold weather and wet weather follows dry weather as night follows day. However, the cost of evacuating a mile of coastline now tops a million dollars, lives are at stake and, in our litigious society, the ramifications of bad forecasting will have legal consequences.

In order the predict the track, time and place of landfall, and storm surge, a number of computer models have been created. As might be expected, many have clever acronyms for names. CLIPER (CLImatology and PERsistence), a early statistical program, is a "Krick-like" model based upon the assumption that the storm will maintain its current velocity in the short-term, say 24 hours. After 24 hours, it will move in the same way as previous storms with similar climatological parameters. I have experimented with this myself and for well-behaved weather phenomena it works surprisingly well. However, hurricanes are like Monty Python's Spanish Inquisition and surprise is never far away.

Dynamic models rely on the fundamentals of physics. Six equations are commonly used. Three of them are called hydrodynamic equations and factor in the horizontal and vertical air velocities, friction, and the rotation of the earth. Two thermodynamic equations consider the condensation and evaporation of water and the concomitant release and absorption of energy and consequent temperature changes. The continuity equation models the ingress and egress of air in the volume under study.

Before the massive increase in computing power and the increased use of data platforms such as weather satellites, and buoys, numerical forecasts based on physics were generally inferior to the forecasts based on statistical models. That is no longer true. The power of today's number crunchers is enhanced by specialized computer techniques in such a way that the enormous amount of data available can be analyzed in time to be useful but theoretically, no amount of calculation will probably ever yield perfect predictions.

MIT's Edward Lorenz discovered that very small changes in the initial input conditions of a system will yield enormous differences in the output. Most are familiar with the concept of chaos theory as the "butterfly hypothesis." In 1972, Lorenz published a paper entitled "Does the Flap of a Butterfly's Wing in Brazil Set off a Tornado in Texas?" The idea is that some small input at any of myriad places can have enormous effects down the line. As Sheets and Williams state, "The grid for the computer model...keeps getting smaller...but we're still talking in terms of miles while the actual weather is taking place at the level of molecules. Imagine trying the study all of the inputs possible on the molecular level for a system the size of the earth!

A chapter on 1992's Hurricane Andrew describes how seven different computer models were utilized to develop the official prediction for the track of the storm. Sheets, then Director of the National Hurricane Center (NHC) was a key performer in the juggling of the data and analyses during the 11 days of Andrew. The hurricane intensified as it approached and became the third most powerful documented storm to strike the United States causing damages in excess of 30 billion dollars but with a death toll of less than 30, thanks to solid forecasting and good emergency preparation.

Ironically, one of the victims of the storm was the NHC building. Their radar, on the roof of the building, was blown off its mount when the wind speed was 147 mph. The anemometer stopped recording at 167 mph! Water, air-conditioning, necessary for the computers, and communications all experienced failures. Yet the personnel continued to perform their duties and are now graced with new and superior facilities on the campus of Florida International University.

The most dangerous phenomena associated with hurricanes is the storm surge. The lowered air pressure over the sea and a higher than normal tide can combine with ocean bottom and coastline topography and heavy rains to produce extraordinary flooding. This flooding effect is increased even more if the storm is moving at a high speed and has high rotational velocities. The

leading right quadrant of the storm will then give an extra forward push to the water. Add wave effects to these conditions and disaster is guaranteed. These conditions are similar to those which devastated the Long Island, Connecticut and Rhode Island shores when the Hurricane of 1938 struck.

The Long Island Express: Tracking the Hurricane of 1938 by Roger K Brickner with David M. Ludlum is a wonderful collaboration by a dedicated amateur, Brickner, and the dean of weather historians, Ludlum. The book contains reproductions of the National Weather Bureau maps, photographs and very good line drawings to present a detailed account of the 1938 storm. The center of the 500 mile wide storm crossed Long Island by Lake Ronkonkoma and passed over the Connecticut coast. Rotational speed was around 100 mph but the forward speed of the storm approached 60 mph. This means that the shoreline east of the center of the storm experienced wind speed of 160 mph.

The Bostonian, a New York, New Haven, and Hartford express train was stalled on a causeway near Stonington, Conn. The debris which blocked the tracks consisted of a house and a cabin cruiser! The train was eventually blown off the tracks but only two lives of the 275 on board were lost, both by drowning.

Two computer programs have been developed to predict the effects of the surge. SPLASH (Special Program to List Amplitudes of Surges from Hurricanes) is designed to predict coastline effects. SLOSH (Sea, Lake, and Overland Surges from Hurricanes) predicts the inland effects. In the Hurricane of 1938, the city of Norwich, 10 miles up the Thames River from Long Island Sound, suffered flooding which reached the second story of riverfront buildings. Willimantic, some 30 miles inland was flooded. The rise of fresh water, incapable of draining off into saturated ground and swollen rivers can be prodigious. For people on the flats, it can be disastrous. A 1970 typhoon which struck the delta lands of what is now Bangladesh has been estimated to have caused over 300,000 deaths, mostly by drowning.

Some storms have their own "biographers." I have previously mentioned the Brickner volume about the New England Hurricane of 1938. Eric Larson published the best seller, *Issac's Storm: A Man, A Time, and the Deadliest Hurricane in History* in 1999. The book is a gripping portrayal of Issac Cline, a Weather Bureau official and the horror of The Great Galveston Hurricane of 1900 which took as many as 10,000 lives in the worst natural disaster to ever strike the United States.

A year later, Pete Davies published *Inside the Hurricane: Face to Face with Nature's Deadliest Storms*. He portrays the people who investigated and suffered during the 1998 and 1999 hurricane seasons and focuses on Hurricane Bret in "98 and Mitch and Floyd in '99. This year, Robert Mykle published *Killer 'Cane: The Deadly Hurricane of 1928*. This event is sometimes called the Lake Okeechobee Hurricane and left around 2,400 dead in its wake. All three of these books tend to emphasis the social aspects of a hurricane strike and rely heavily on documentary and eyewitness reports.

Read the accounts of the storms which occurred in the first half of the 20th century and one quickly becomes aware of the many orders of magnitude of progress which we have made in locating storms, predicting their future locations, and warning the threatened populace. The 1900, 1928, and 1938 storms were tracked over water by their occasional and somewhat random sightings by ships and their passage over islands. Aircraft reconnaissance did not become common and organized until the 1950's and satellite imagery had to await the 1960's. People were caught unaware on low shorelines or the delta of large rivers such as the Ganges and the Mississippi and in areas prone to flash flooding such as piedmonts. As a result of this lack of data, loss of life was much higher in the past. Yet now, the inflationary pressures have increased property losses to astronomical levels.

My professional interest in hurricanes is as a teaching tool. Back around 1988, some of my students and I started developing weather satellite

downlinking equipment and software so we could do real-time meteorology in the classroom. The initial enterprise was successful and has spun off several thriving corporations. There are numerous pedagogical possibilities for using such equipment in the classroom. Hurricanes fascinate students and are a natural "hook" for capturing their attention. Studying the phenomena in real time adds the lure of realism. Following a storm requires perseverance and attention to detail. It is a natural time to teach mapping skills such as latitude and longitude and mathematical skills such as computing velocities. From the point of view of physics, hurricanes are earth-scale engines of equilibrium and fluid flow, thermodynamics, and state changes may be profitably discussed to make the storm intelligible.

After the near record 1995 hurricane season, we produced a CD-ROM, *Hurricanes 95*, a compilation of all of the imagery which we collected, hyper-texted annotations, and National Hurricane Center data. The construction of the hardware, writing of the software, operation of the equipment, and analysis of the data provided a full plate of science and technology education.

The use of satellite observations have provided the meteorology community with a planetary overview of hurricanes. But a "ground truth" of surface and near surface based observations is still required to refine predictions and validate theories. Tools such as Doppler radar, automatic weather reporting stations on ocean buoys, and global positioning satellites all contribute but of all these instruments, the "hurricane hunters" of the Air Force Reserve and the National Oceanic and Atmospheric Administration have the most exciting duties.

During World War II, an Eastern Airline pilot on active duty with the Army Air Corps made the first deliberate penetration of a hurricane. Col. Joseph Duckworth ran the Air Corps school for training instrument flight instructors. In order to prove the further prove the usefulness of instrument flight and the toughness of the aircraft, he flew an North American AT-6 Texan through a hurricane and into the eye on 27 July, 1943 just to the north of Galveston, Texas.

Eighteen months later, Admiral William Halsey's Third Fleet encountered a typhoon, the North Pacific name for a hurricane, which sank three destroyers, wrecked 150 aircraft, and killed almost 800 sailors. Nine ships, including five aircraft carriers, were severely damaged and their services were lost to the war effort.

Halsey's 2nd Typhoon, Connie, peeled down the flight deck of U.S.S.Hornet (CV-12) *(Credit: US Navy)*

"Halsey's Typhoons" led to an intensified effort by the United States Navy to increase weather reconnaissance flights and improve the techniques for gathering and analyzing data and promulgating the information to the fleet.

Part of the story of the Navy effort is chronicled in H. J. Walter's *Wind Chasers: The History of the U.S. Navy's Atlantic Fleet "Hurricane Hunters."* Walter's book is a typical unit history, short on science but long on detailed accounts of missions and personnel. Walter spent three years with Airborne Early Warning Squadron 4 so his first hand account has an authoritative cachet. For a wider account of the early days of aerial storm chasing, I would recommend that you take a look at Ivan Ray Tannehill's 1955 volume, The Hurricane Hunters. Tannehill spent 40 years as a meteorologist and he provides a summary of pre 20th century storms and a reasonably broad account of the first decade and a half of airborne hurricane investigations. Additionally, he has a nice set of photographs of air views of storm phenomena such as surface waves and some photos of crews at work in both air force and navy equipment.

In 2002, David Toomey's *Storm Chasers: The Hurricane Hunters and Their Fateful Flight into*

Hurricane Janet appeared. Toomey is a member of the English faculty at the University of Massachusetts at Amherst In January of 1955, Commander Grover Windham and his crew of eight flying a Lockheed P2V-5F, call sign Stormcloud 5, departed Guantanamo Bay NAS, Cuba and entered the maw of Hurricane Janet. They were never seen again.

A P2V-5F Neptune *(Credit: William Larkin)*

This incident was one of the very rare instances of the destruction of a "hurricane hunter" aircraft and Toomey's account of the mission is both gripping as well as informative. He provides sufficient background on hurricanes, personnel, and aircraft so that the reader is presented with a yarn, well balanced in human interest, scientific knowledge, and technical detail.

Currently, United States efforts to survey Atlantic hurricanes from aircraft is being carried out by the U.S. Air Force Reserve's 53rd Weather Reconnaissance Squadron. They fly specially equipped Lockheed WC-130H (now the J model) Hercules out of Keesler Air Force Base near Biloxi Mississippi. Their primary mission is to acquire data for the operational meteorologists in order to predict the tracks and landfalls of tropical storms and hurricanes.

A Herky from the 53rd ARS *(Credit USAF)*

In contrast the Air Operations Center of the National Oceanic and Atmospheric Administration (NOAA) operates a small fleet whose primary purpose is scientific research. These aircraft carry nose art depicting Muppets. Two Lockheed WP-3D Orions, *Ms Piggy* and *Kermit* have carried out the bulk of the work. A Gulfstream V-SP, *Gonzo* joined the fleet in 1997. This new aircraft can fly at higher altitudes than the Orions and collect previously inaccessible data, such as the upper air steering winds which influence the course of hurricanes.

Two of NOAA's fleet of research aircraft, the Gulfstream V-SP and one of the Orions. *(Credit: NOAA)*

The utilization of the latest technology such as super computers, satellites, aircraft, moored buoys, GPS equipped dropsondes and expendable bathythermographs should improve the theoretical underpinnings necessary to produce accurate real-time predictions. Although 2002 is an El Nino year and consequently, Atlantic hurricane activity was low, expect the unexpected. Hurricanes will never be completely predictable and exposed regions such as the City of New Orleans and the barrier beaches of the Atlantic and Gulf coasts will remain vulnerable to the terrible power of the hurricane.

Follow-up information may be obtained from the listed web sites:
http://www.nhc.noaa.gov/ (NHC
http://www.hurricanehunter.com/ (The 53rd WRS)
http://www.hurricanehunters.noaa.gov/ (NOAA)