Well, the world didn’t end... so it’s back to work after all.
See inside for pictures from the Volunteer Christmas Party
Once again our Volunteer Christmas Dinner was a huge success. Thanks to Events and Staff for all their hard work.

Remember . . . The chef needs a true count of guests in order to have enough food for everyone. So, be sure to respond to any RSVP request.

Also, keep in mind the parties are only for current active volunteers. Thanks

Our Mission:

To inspire and educate
To promote and preserve aviation and space history
To honor the patriotic service of

God grant me a vacation to
Make bearable,
What I can’t change,
A Friend to make it funny,
And the wisdom to never get my
Knickers in a knot, because
It solves nothing,
And makes me walk funny.

JANUARY BIRTHDAYS

1- Bob Parry
3- Chuck Howell
4- Arthur Avery
6- Walter Friday
6- William Vicory
7- Jack Dugan
8- Mary Lou Beach
8- Mark Kriska
9- Tim Burnett
10- Richard Gehrke
10- Ross Phillipi
11- William Powell
14- Evelyn Lorence
14- Michael Harford
15- Laurel Adams
15- Gary Werner
19- Charles Bell
20- Susan Harvey
20- Don Johnson
20- Ronald P. Johnson
20- Lee Lazarone
22- Chad Eason
23- Fern Oliver
24- Jonathan Lloyd
25- Milt Thompson
25- Sue Vergara
27- Al Dozler
29- Peggy Church
30- Wayne Huberd
31- Benjamin Waldorf
31- Sean Ireland

Is your Birthday missing from the list???
Send an email to Katha Lilley
tootiekat@live.com
ENSIGN KOGA’S ZERO – PART THREE

We continue from last month when Ensign Koga’s plane was discovered with his body still hanging from the cockpit inside his practically intact Zero. In 1947 his remains were transferred to a cemetery on nearby Adak Island; later, it is believed, his remains were returned to Japan.

Lt. William Thies had determined that the wrecked plane was a nearly new Zero, which suddenly gave it special meaning for it was reparable. However, unlike U.S. warplanes, which had detachable wings, the Zero’s wings were integral with the fuselage. This complicated salvage and shipping. Navy crews brought the plane out of the bog. The tripod that was used to lift the engine, and later the fuselage, sank three to four feet into the mud. The Zero was too heavy to turn over with the equipment on hand, so it was left upside down while a tractor dragged it on a skid to the beach and a barge. At Dutch Harbor it was turned over with a crane, cleaned, and crated, wings and all. When the awkward crate containing Zero 4593 arrived at North Island Naval Air Station, San Diego, a twelve-foot-high stockade was erected around it inside a hangar. Marines guarded the priceless plane while Navy crews worked around the clock to make it airworthy. (There is no evidence the Japanese ever knew we had salvaged Koga’s plane.)

In mid-September Lt. Cmdr. Eddie R. Sanders studied it for a week as repairs were completed. Forty-six years later he clearly remembered his flights in Koga’s Zero. “My log shows that I made twenty-four flights in Zero 4593 in September and October, 1942,” Sanders said. “These flights covered performance tests such as we do on planes undergoing Navy tests. The very first flight exposed weaknesses of the Zero that our pilots could exploit with proper tactics. The Zero had superior maneuverability only at lower speeds used in dog fighting, with a short turning radius and excellent aileron control at very low speeds. However, immediately apparent was the fact that the ailerons froze up at speeds above two hundred knots, so that rolling maneuvers at those speeds were slow and required much force on the control stick. It rolled to the left much easier than to the right. Also, its engine cut out under negative acceleration (as when nosing into a dive) due to its float-type carburetor. We now had an answer for our pilots who were unable to escape a pursuing Zero. We told them to go into a vertical power dive, using negative acceleration, if possible, to open the range quickly and gain advantageous speed while the Zero’s engine was stopped. At about two hundred knots, we instructed them to roll hard right before the Zero pilot could get his sights lined up. This recommended tactic was radioed to the fleet after my first flight of Koga’s plane; and soon the welcome answer came back: It works!” Sanders said, satisfaction sounding in his voice even after nearly half a century.

By late September, 1942, Allied pilots in the Pacific theater knew how to escape a pursuing Zero. Sanders was asked if Zero 4593 were a good representative of the Model 21 Zero. In other words, was the repaired airplane 100 percent? “About 98 percent,” he replied.

The Zero was added to the U.S. Navy inventory and assigned its Mitsubishi serial number. The Japanese colors and insignia were replaced with those of the U.S. Navy and later the U.S. Army, which also test-flew it. The Navy pitted it against the best American fighters of the time—the P-38 Lockheed Lightning, the P-39 Bell Aircobra, the P-51 North American Mustang, the Grumman F6F Hellcat, and the F4U Chance Vought Corsair—and for each type the most effective tactics and altitudes for engaging the Zero were developed.

BOB OSBORN
Questions and or comments always welcome. Email me at: osbornrlawrence@frontier.com

WELCOME NEW VOLUNTEERS
Stan Strong,
Beverly Granger, and
Gerald Heister
BOEING –GOOD, but LUCKY??

In 1933 Boeing developed a break-through air transport, the Model 247. Good, but unluckily Boeing’s attempt to orchestrate sales was seen as anticompetitive and resulted in the Federal break-up of the Boeing family of aviation companies.

Boeing was left with only airframe production and little resources for further research and development. As a result, the Douglas DC-2 swiftly out-classed the 247. Now Boeing would have to survive on military contracts to develop the XB-15 and XB-17 airframes for the U.S. Army Air Corps.

Good, but unlucky the 1937 XB-15 became a dead-end design. Intended as a heavy bomber capable of delivering a one ton payload over a 5,000 mile range at 200 mph, the effort failed when development of the 2,600 hp Allison X-3420 was extensively delayed. To produce the one prototype XB-15, four 850 hp Pratt & Whitney R-1830s were substituted. The step down from 2,600 hp to 850 hp resulted in an aircraft unable to achieve anything near its lofty goal. Operational speed was closer to 145 mph than 200. Never-the-less, the design could lift a record 8,000 lb payload and introduced the use of an autopilot, deicing equipment, and an on-board auxiliary power unit. In 1939 the prototype XB-15 carried over a ton and a half of emergency relief supplies to earthquake-ravaged Chile.

Previously in 1935 the XB-17 had also been intended as a bomber capable of delivering a one ton payload, at 200 mph, however for a shorter 2,000 mile range. The U.S. Army Air Corps was enthusiastic about the Boeing design – good – but on the crash of the prototype it was forced by Congress to go with the twin-engine Douglas B-18, reducing the promised purchase of 65 B-17s to just sixteen aircraft.

Unlucky again, the sixteen B-17s and the single XB-15 left necessary research under-funded and Boeing production capacity underutilized. What to do? Well, Wellwood Beale, a Boeing engineer and future VP, clearly foresaw the Martin M-130 China Clipper would replace the Sikorsky S-42s as the premier long-range “flying boat” in the Pan Am fleet. Flight-tests were demonstrating that the XB-15 wing was superior to the M-130 wing. Working nights and weekends on his dining-room table Mr. Beale hung a boat hull under a XB-15 wing and created the now famous Model 314 Boeing Clipper. Entering service in 1939 twelve Clippers were produced prior to production being suspended by WW II.

At the same time, the B-17 also had an excellent wing and Douglas was heavily committed to their very successful two-engine commercial transport DC-3 market. So Boeing leaped over the two-engine designs of Douglas and Lockheed, and the three-engine designs of Europe and mated a pressurized cabin to a B-17C wing producing their four-engine Model 307 Stratoliner. Designed to cruise “over the weather” at 20,000 ft the Stratoliner used the tail, rudder, landing gear and engines in addition to the wing of the B-17.

Entering service in 1940, ten were delivered which served throughout WW II as C-75s.

After the war all ten Stratoliners were returned to Boeing and updated with B-17G wings, etc. before reentering commercial service. One still survives in flying condition at the Smithsonian, having been delivered after a short bath in Elliott Bay, three miles short of Boeing Field, Seattle WA.

So is it true that Boeing Commercial Aircraft business is government subsidized? Well YES, but not as the European industry is subsidized. Boeing has always competed in the market place for a government contract first, and then later has used the knowledge and profits gained to develop their own new commercial products. In Europe Boeing’s competitors go first to their governments asking for funds, loans, guarantees, etc. to subsidize the development of their commercial products.

Earl Scott

Next month: Developmental problems with the Boeing Clipper and Stratoliner.
To say that Bob Ruck has had a lifelong love affair with airplanes and flying would be an understatement! He was born in Irvington, New Jersey, in 1946. The war was over, but the stories told to him by his father and uncle kindled a fascination to fly that endures today. The fact that they had three small airports near them was a major thrill! At age 15, he took his first flying lesson and had to bicycle some distance to get to the little airport, but it was always worth the trip! His flying instructor, Edward Gorski, had been one of Amelia Earhart’s mechanics. From the first lesson, you could always find Mr. Gorsky sitting in the rear seat, with his cigar in his mouth, yelling out the directions!

Bob’s family moved to Peterborough, New Jersey, where his father worked at Curtis Wright for 15 years. Hanging around his father’s friends primed his imagination and desire to fly even more. He got his private pilot’s license in 1970. He moved to Ontario, California, in 1976 and went to work for Gilbert Plastics. He became the plant manager and was able to follow his dream with planes of his own with a 250 Comanche and a 150 Cessna! With these in tow he moved on to Arizona, where he ran machine shops and did precision injection molding.

By 1993, he had moved to Lebanon, Oregon, and opened his own business. He now had his commercial and instrument ratings and replaced his planes with a 250 Comanche and a Tri-Pacer (Piper). He retired after 18 years of running his business and began an entirely new life.

Bob and his wife, Christine, are both licensed pilots and motorcycling enthusiasts. They currently ride with the Patriot Guard riders. Both are captains in this wonderful group…their motto: “WE STAND FOR THOSE WHO STOOD FOR US” says it all. This group serves in many capacities. They are there to greet those returning from overseas duty, circling around them with welcoming cheers and lights. They place wreaths on burial sites and make contact with the families and do whatever the family needs or wants, even arranging a military burial.

(Perhaps you remember a few years ago when a large contingent of riders was present to support and protect a family as they mourned the loss of their son amid a rowdy group of protestors.) From grave sites to welcoming home our warriors…the Patriot Riders are there!

In the Aviation Museum, Bob is always ready to help and share his abiding love for flying with many visitors. He is always one of the first to arrive on his “Museum day” and one of the last to leave.  

Lynn Gelinas

Our entertainment during the Volunteer Christmas Dinner

Ken and Melinda Buckles

Norma Guerrera

Images by: Katha Lilley
Fabulous Veterans Program

It’s Friday afternoon. Two hours ago, I arrived home from the most awesome five-day celebration of Veterans’ Living History I could ever hope to experience. About 60 to 80 veterans from World War II, Korea, Vietnam, Desert Storm, Iraq, Afghanistan and Cold War periods took time this week to speak to about 2,400 students from 18 local schools.

The amazing logistical organization was carried out under the command of Ken Buckles, the originator of Veterans Living History Day. His right arm at the event, Jim Gadberry, was master of this chess game, moving all 600 kids a day up, down and all around, to listen to us. This fabulous program was in the Evergreen Space Museum, thanks to Del Smith.

Each day, a complimentary breakfast and picnic lunch were served to the speakers, courtesy of the museum. And each afternoon, I’ll bet each of us went home directly to a nap. For me, it was beautifully exhausting.

Students were asked to dress up as a show of respect. And did they ever! Many boys wore dress shirts and ties; others appropriate casual wear. Girls wore dresses or skirts, all looking their best. Behavior was above reproach. Enthusiasm was palpable. They performed wonderfully. The day after the trip, two girls from Dayton High event sent me a thank-you letter.

Breakfast and lunches allowed me personal visiting with a Tuskegee Airman, a Navajo code talker, a Pearl Harbor survivor and veterans of Iraq and Afghanistan. I was greatly humbled. My patriotic self was renewed with thanks for my freedom, my country and my God, who brought all these veterans home.

I’ve heard that this was the first and largest Living History event ever conducted in the nation, and that it may be repeated next year in early November.

Peggy Lutz, World War II Wave

McMinnville


JANUARY LAUNCH PAD

<table>
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<tr>
<th>DATE</th>
<th>LAUNCHER</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>TBD</td>
<td>KSLV 1</td>
<td>South Korea Space Launch Vehicle -- payload is a Science and Technology Satellite 2C (STSAT 2C) demonstration spacecraft.</td>
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<tr>
<td>TBD</td>
<td>Proton</td>
<td>An International Launch Services rocket -- Satmex 8 will provide video distribution, broadband, cellular backhaul and distance learning services in North &amp; South America.</td>
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<tr>
<td>28</td>
<td>PSLV</td>
<td>India’s Polar Satellite Launch Vehicle launches the SERAL altimetry Satellite -- a collaboration between France and India designed to measure sea surface height from space. The rocket will also carry Canada's Sapphire space surveillance payload and NEOSat space telescope to search for near-Earth asteroids.</td>
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<tr>
<td>29</td>
<td>Atlas 401</td>
<td>Atlas 5 rocket -- launch the TDRS K communications and relay satellite for NASA to connect mission control with the ISS and other orbiting satellites.</td>
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<tr>
<td>TBD</td>
<td>Zenit 3SL</td>
<td>Sea Launch the Intelsat 27 communications satellite into synchronous equatorial orbit to provide communications services for media, network and government customers over the Americas &amp; Europe.</td>
</tr>
<tr>
<td>TBD</td>
<td>Proton</td>
<td>Russian rocket will deploy an Breeze M Anik G1 satellite to provide Ku-band direct-to-home</td>
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Speaking at the Museum -- Jim Cameron introducing Christel

During Veterans’ History Week, Christel Jonge Vos of Keizer, Oregon, visited the Space Museum and spoke to a group about her experiences in Berlin, Germany. Her talk took place near the piece of the Wall located in the Museum.

Christel was born and raised in Berlin and was living there during WWII, the Berlin Airlift, and the years of the Berlin Wall. She later came to live in the U.S. with her husband in 1972 and became a U.S. citizen. She has finished her book “Pathways away from the Edge” where she relates many of her Berlin experiences. Several of us volunteers enjoyed listening to her commentary from her book.

She holds a Master’s Degree in Music Performance and Music History and has played in numerous concerts in the Portland area. In 1981 she started The German Language Center, which offered German language instruction and translations for companies, conducting business in Germany, professors and scientists, as well as for the general public. She also taught graduate students in total immersion at Portland State University, at Lewis and Clark College, and the University of Albuquerque.
5 Minute History
THE WRIGHT BROTHERS AND THE BOY Scouts

Ask any Boy Scout about the founder of their organization and the odds are that answer would be Lt. General Robert Baden-Powell in England in 1907.

But did you know that Robert had a younger brother Baden F.S. Baden-Powell? Like his older brother Robert, Baden was an Army Officer. He served with the Scots Guards, one of England's most distinguished regiments, and became an expert in using balloons and kites for collecting military intelligence. In an 1894 experiment, he was lifted into the sky by a kite 36 feet tall. He is also credited with writing the Kite Flying entry in the 11th edition of the Encyclopedia Britannica.

Baden is considered by many as a military aviation pioneer. He was a Fellow and later President of the Royal Aeronautical Society and a Fellow of the Royal Geographical Society. He was one of the first to see the use of aviation in a military context. As an island nation England had historically protected itself by maintaining a strong naval presence. She "Ruled the Waves" as the song goes. Baden foresaw that with the advent of man being able achieve controlled flight, the country could no longer rely on its Navy alone to protect her borders.

In the pioneering days of aviation, it was not uncommon for contemporaries to share information, albeit guarded, and to keep tabs on what others were doing through newspaper and magazine articles and by observing attempted flights. Some actually utilized spies and paid informants.

Beginning in January, 1904, correspondence began between the Wright Brothers and the members of the Royal Aeronautical Society. In response to a letter from Baden, Wilbur sent him a newspaper clipping containing his (Wilbur's) statement regarding the latest trials of the Flyer. Correspondence continued over time; and when the Wrights took the Flyer to France in 1908, Baden met the brothers and was even given a ride in the Flyer.

Baden and the others who accompanied him to France convinced British government officials to inquire about purchasing planes from the Wrights. Wilbur replied that if five planes were ordered for £1,000 each he would throw in flying lessons. Buying something sight unseen was a hard sell to skeptics.

The July 1932 issue of Scouter Magazine contains the comment by Baden that "...it has been suggested that Air Scouts should be organised in the same way as Sea Scouts. "Though the air is 'ever with us', access to aerodromes is not common and though Sea Scouts can mess about 'in any old boat', a Scout is unlikely to be able to get access to an aeroplane, and even if he did he would not be able to fly it. ...it seems hardly feasible to have special 'Air Scouts', yet a great deal may be accomplished by troops specialising (sic) in air-work... I shall always be pleased to give what advice I can."

Check out a book by Alfred Gollin entitled "No Longer An Island" for a thorough yet easy to read discussion of how England adapted to the advent of aviation. The tie-in between the Wrights and the Boy Scouts can also be a talking point for the Evergreen commitment to Scouting.

Spencer Vail

Thanks to the staff for all their hard work. We know it wouldn’t happen without you...
RESTORATION HAPPENINGS

Can you really believe it? -- 2012 is now behind us; and if you are like me, you are looking for Hope and Joy in 2013. The year ended on a sad note for us in Restoration and the sadness will continue for a while into the New Year. For personal reasons, Restoration Director Bryan Marsh, has decided to leave the Museum and pursue another direction. We all miss him very much and wish him and his family the best. Bryan was extremely easy to work with and a very knowledgeable aviation person. The process starts again to find a highly qualified Restoration Director.

We closed out last year with the delivery of the Grumman G12 Goose to the Aviation Museum with a few loose ends to completely finish the aircraft. This unfinished work will give the visitors a chance to watch behind-the-scenes action that takes place in our Restoration area.

The new hangar queen is the reassembly and modification of the Vultee BT-13 Valiant. The rigging of the control system has been quite a challenge but is pretty well solved. Most of the fabric repair has been completed. When the control surfaces have had their fit check, they will be removed and set aside for paint. We still need to come up with an engine that will fit our requirement. Our next step will be to make sure all the fuse-lage panels and wing cover plates fit properly. We also will start repair and cleanup on the big engine cowl and the propeller.

Due to higher priorities, the two engine projects have been on hold, but are now back on the burners and near completion. The Hiller Flying Platform has been repaired and is ready to go back to the helicopter section in the Space Museum. Just received is the only DeLackner HZ-1 Aero Cycle left in the world. Looks like it will need quite a bit of work, but should be an interesting project. The Lazer equipment will be moved to the new green barn for storage. The Lilienthal glider has been set aside, waiting for a go ahead.

"Quote of the Month"
I confess that in 1901, I said to my brother Orville that man would NOT fly for fifty years..... ever since I have distrusted myself and avoided all predictions.

Wilbur Wright

Bob Peterman

PROFILE:
LEE LAZARONE,
THURSDAY DOCENT

Lee Lazarone was born in New Orleans in 1960 and has always been interested in aviation. Enough so that while still in high school, he put in four years in the US Jr ROTC. In 1978 Lee enlisted in the USAF. He spent 9 ½ years on active duty, part of which were at Tempelhof Central Airport, three years and four months to be exact. During WWII this was Hitler’s Luftwaffe headquarters. Lee was a staff member maintaining long-range and height-finder radars and job control (Maintenance Control and Command Center for the 1946th Communication Squadron.)

He also spent five years at Plattsburgh AFB, New York. Another four years was spent maintaining the electronic warfare systems on the FB-111A aircraft. Then one year in Quality Assurance inspecting the 380th AMS Sq, 380th AMS Sq, 380th BW, 8th Air Force.

Lee then was in Atlanta, Georgia, for over seven years working in the electronics industry. (small computer company and newspaper.)

He moved to Portland in January, 1996, when he joined Intel where he spent ten years working in the “fabs” making wafers and four years in the “motherboards” group designing and testing the latest desktop and laptop motherboards.

He’s married to Debby and has a son Dustin. Lee joined the Thursday crew as a docent in September, 2011.

Bob Osborn
Please don’t be one of the INDIVIDUALS WORKING ON THE AIRPLANES AND DISPLAYS.

Inflating tires is very dangerous. If they are inflated incorrectly, the tires can explode. We use nitrogen in our tires to maintain proper inflation levels longer.

**WANT TO WORK IN MAINTENANCE??**

If you would like to be part of our maintenance crew please contact Ross Philippi or Stewart Bailey and they will be happy to sign you up. Thanks

**BECOME A VOLUNTEER**

Would you like to become a Volunteer/Docent at the McMinnville Evergreen Museums? If so please visit the website at http://www.evergreenmuseum.org/volunteer and follow the instructions.

The benefits of being a volunteer are many: meet new people, help the community and in return learn new skills yourself. You don’t need to know all about airplanes or space to apply… you will be trained. Please join us, we do have fun. Tell your friends and relatives, too.

Date: January 26 2013
Time: From 10:00 AM to 3:00 PM
Cost: $5 per participant
**Check In:** 9:30 am in the Aviation Museum
**Event Time:** 10 am – 3 pm

**MEMBER APPRECIATION MONTH**

**February 2**
Membership Appreciation Breakfast-8:30am/ Theater Building

**February 9**
Gun Room/Restoration Area Tour- 10am, 11am and 1pm (Limit one guest per member)/ Eagle Building

**February 16**
Movie and Wine Tasting- 5:30 pm/Theater

**February 23**
The Paper Airplane Guy-8am/ Aviation Museum

Put these dates on your calendar. Times are subject to change – Jeff Cool, Membership Director
DECEMBER BOARD OF CAPTAINS MEETING

Membership Director Jeff Cool reported that memberships and revenue are up for 2012. Because the layout of the aircraft in the Aviation Museum changes fairly regularly, the docents are encouraged to familiarize themselves with the changes before conducting tours to avoid confusion.

Development Director Steven Guntil has sent out a mailer to all members about fund-raising for the Museum. A small handout will be provided for all visitors.

The BOC complimented Phil Jaeger on the Christmas party. The only problem – many volunteers came to the party without responding that they would be attending. **It is extremely important for any event that a response is necessary so that adequate food can be ordered.** Also these events are open only to active volunteers.

Curator Stewart Bailey reported that a volunteer brought a pressure tank in and filled some tires on the artifacts in the Space Museum. Only trained and qualified volunteers should be doing this with the approval of the Curator. The same goes with handling, changing, moving, or modifying any artifact in either of the Museums.

The Grumman Goose has been moved into the Aviation Museum. The Restoration crew will continue their work there. The JPL Curiosity Rover will be in the Museum in February. “In Plane View” exhibit from the Smithsonian is here, but it needs a 300-foot wall for display. For the time being, it remains in crates.

Outdoor signs were made in the wrong size by the manufacturer and are being redone. Indoor signs are still in the works.

Recruitment and numbers of new volunteers are down. Paul Gelinas asked for volunteers who could appear at area club meetings to promote volunteering. Katha will put a notice in the next newsletter because it is read by friends and families in surrounding communities.

Be sure to inform your Day Captain if you hear incorrect information from staff or volunteers so that corrections can be made. **Jim Lilley**

2013 Tuesday Aerospace Museum Training Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Docent Presenter</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 7</td>
<td>Gary Sohn</td>
<td>Nuclear devices, the background/how built</td>
</tr>
<tr>
<td>Jan 14</td>
<td>Charles Nail</td>
<td>Speed of Sound/Sonic Boom</td>
</tr>
<tr>
<td>Jan 22</td>
<td>To be Announced</td>
<td></td>
</tr>
<tr>
<td>Jan 29</td>
<td>Jim Cameron</td>
<td>Mig 21</td>
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Training class time: 0930-1030. Guests are always invited.

DVD copies are available for checking out in the Lunar Lounge. For a copy of the complete listing of classes conducted, contact Elliott Abram at shellback243@me.com or call 503-476-5973.
**JUNO SCIENCE PAYLOAD**

The Juno spacecraft is in the first year of its 5-year journey to Jupiter. The mission goal is to improve understanding of the solar system’s beginnings by examining the origin, evolution, and structure of Jupiter. Specifically, Juno’s science objectives are to:

- Determine how much water is in Jupiter’s atmosphere.
- Look deep into Jupiter’s atmosphere to measure composition, temperature and cloud motions.
- Map Jupiter’s magnetic and gravity fields, revealing the planet’s deep structure.
- Explore and study Jupiter’s magnetosphere near the planet’s poles, especially the auroras – Jupiter’s Northern and Southern lights.

To accomplish these objectives Juno’s scientific payload includes:

- **The Gravity Science, GS, experiment** will measure Jupiter’s gravitational field and reveal the planet's internal structure. Such measurements determine whether the planet harbors a dense core at the center. The experiment works by taking advantage of how variations in Jupiter's inner structure will induce changes in Jupiter's gravitational field. Such variations will alter the spacecraft’s orbit. These shifts in Juno's motion cause shifts in the frequency of radio signals exchanged by the spacecraft and Earth. This is the Doppler Effect one hears when a train passes.

- **The Microwave Radiometer, MWR, probes** deep into Jupiter’s atmosphere to learn about its chemical composition. The MWR is an array of six radiometers that measure the microwaves coming from the planet core through six different cloud levels. Each cloud level forms at unique pressure and temperature conditions. The microwave intensities measured by the array tell atmospheric scientists about the values of these conditions and the atmospheric composition, specifically the water content, in each cloud band.

- **The Flux Gate Magnetometer, MAG,** is a magnetic field investigation with three goals: mapping of the magnetic field, determining the magnetic dynamics of Jupiter's interior, and determination of the three-dimensional structure of the polar magnetosphere.

- **The Jupiter Energetic Particle Detector Instrument, JEDI,** measures energetic particles that stream through space as they interact with Jupiter's magnetic field. These electrically charged particles follow the influence of the magnetic field with many being channeled toward Jupiter’s poles where they crash into the atmosphere and create brilliant auroras. JEDI will determine the amount of energy these particles carry, their type and the direction of motion to better understand how Jupiter’s auroras are produced.

- **The Jovian Auroral Distributions Experiment, JADE,** will work with some of Juno’s other instruments to identify the particles and processes that produce Jupiter’s stunning auroras. JADE consists of an electronics box shared by four sensors: three will detect the electrons that surround the spacecraft and the fourth will identify positively charged hydrogen, helium, oxygen and sulfur ions. These sulfur ions are ejected from the volcanoes on Jupiter’s moon, Io. These instruments will help create a three-dimensional map of the planet’s magnetosphere.

- The Waves instrument will measure radio and plasma waves in Jupiter’s magnetosphere, to understand interactions between the magnetic field and the atmosphere.

- The Ultraviolet Imaging Spectrograph, UVS, will take pictures of Jupiter’s auroras in ultraviolet light.

- **The Jovian Infrared Auroral Mapper, JIRAM,** is an infrared imager/spectrometer used to study the dynamics and chemistry of Jupiter’s auroral regions.

JUNOCAM, a visible light camera/telescope, will probably operate for only seven orbits around Jupiter because of the planet’s damaging radiation and magnetic field. During its design life it should capture remarkable pictures of Jupiter’s cloud tops.

John Jennings

Friday docent Melba Smith and B-17 expert recently spent some time with WWII veteran Larry Brown who served as a Flight Engineer on a B-17 in the Pacific. He related many stories of his missions including a fascinating story of his friendship with General “Hap” Arnold. On one occasion he flew with Hap to Idaho to go fishing. Melba said it was “indeed an honor and privilege to have shared time with this gentleman. It is heroes like this who we honor; their stories must be passed on to future generations.” Thanks to Melba for sharing her story with the newsletter. Ann Trombley