



ASSOCIATES

Sponsored by LOCKHEED MARTIN

Volume 37, Issue 3
July 2021

MARS STAR



MARS STAR has gone digital!!!

If you currently receive a printed copy, you will continue to receive a printed copy. If you wish to receive hard (printed) copies in the future, contact Carl Kaminski at 303-726-1546 or via email at carlcolo@centurylink.net.

MARS Activities This Quarter:

- **MARS at the Rockies** See page 5
- **Annual Picnic on Sept. 8 at Clement Park.** See Pg. 26

MARS Associates: A Social Club for Retirees of Lockheed Martin & United Launch Alliance

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MARS STAR

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CLUB CONTACTS

Bridge	Dave & Kathy Martz	303-683-9524
Car Club	Roger Rieger	303-912-6217
Dinner	Becky & Gary Englebright	303-973-4062
	Anita Kannady	303-794-9210
Golf	Bo Rodriguez	303-798-9157
Hiking	Sue Janssen	303-936-8339
Photography	John Chapter (Pres)	303-986-8277

REMINDER:

If you move, please give the membership VP a change of address. Also, if you are a snowbird, let us know when you are leaving and when you plan to return so your MARS STAR can be sent to you. It costs us 70 cents for each STAR package returned.

(Published quarterly by MARS Associates, Retirees of Lockheed Martin Corporation and United Launch Alliance, Denver, CO)

IMPORTANT PHONE NUMBERS

LM Employee Service Center 1-866-562-2363

MARS Important Phone Numbers

(Be sure to have your MARS ID available)

MARS Delta Dental of CO

Individual Team (representatives)	1-877-516-6512
Ron Rueger (Account Mgr)	303-889-8616

Assured Partners of CO

MARS Delta Dental "Vision" (EyeMed)

MARS Vision Service Plan (VSP)

Jon Elmore	303-228-2206
Hudson Howard	720-510-9505
Sharla Leary	720-510-9507

Aetna/Medicare Plus

1-888-562-8111

Kaiser Advantage Plus

303-338-3800

MARS Associates

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MARS Website: <https://www.marsretirees.org>

Cover:

L: Drawing on their unparalleled engineering, performance, technology and reliability legacies, Lockheed Martin, and General Motors Team-up to develop the Next-Generation Lunar Rover -- this result may allow astronauts to explore the lunar surface in unprecedented fashion. See LM News page 21.

R: Lockheed Martin DAVINCI VERITAS Artwork. (Photo credit: LM) See article on page 22.

From the Editor's Desk

Tom Pighetti (tipighetti@q.com)

Linda Stearns (linda80120@comcast.net)

For comments or corrections, contact Tom (issue editor) or Mike Carroll, V.P. of Communications.

MARS welcomes your submissions. Submissions must be relevant **to the MARS organization**, informative, and **appropriate for this newsletter**. No **personal dialogues or opinion pieces** will be accepted.

Please submit your article for approval **in advance** to the V. P. of Communications. Articles will be included as time / space allows.



President's Corner

By Dick Sosnay

(richardsosnay@gmail.com)

We are glad to see the world slowly starting to get back to normal. By this time, over half the people in Colorado have had their vaccinations, and I believe that almost all MARS members have had theirs. The state no longer has any restrictions on activities due to the pandemic, so we are back to planning for a normal life within MARS. Our next major event is the Senior Recognition luncheon at the Manor House on July 14. By the time this issue gets mailed, we will have had the event, and it will be great to see members once again in person. We have also had our first Happy Hour of the season at the Platte River Bar and Grill and it was another great event. We had about 35 people attend and received several new members as a result. Everyone seemed to enjoy the drinks, appetizers, talking to new and old friends, and just getting together now that the pandemic has eased up in Colorado. We will definitely need to do some more of those this summer. Another event that we had was a presentation by Dave Gingerich on the past, present and ongoing activities by Lockheed Martin in Deep Space Exploration -- it was a fascinating 75 minutes with 25 attendees. As we go forward, we expect to have some of these presentations in-person, but the Zoom application presents an easy way to host meetings and information to our members and this also allows members located remotely from Denver to participate.

I want to let our members know about an activity that we have been informally using over the last several years. We call it a marketing committee. The goal of the committee is to market the MARS Association to Lockheed Martin and United Launch Alliance employees that are thinking about retiring or have recently retired and not yet joined MARS. In addition, the committee is looking for ideas to expand the club activities to continue to make it interesting for current and prospective new members. The committee brainstorms ideas, and those that seem worthwhile are brought forward to the officers and board of directors to discuss and then vote to implement. Results of that committee include such things like the previous presentations we have had on social security, computer security, dementia, and the recent discussion on Deep Space Exploration. Other results have included the poll we conducted a few years ago, and the Happy Hours. There are several other ideas being floated around, so look forward to some additional new ideas. The committee is composed of anyone within MARS who thinks they have ideas for ways to improve and to market the MARS Association. Many of the members are either officers or directors, but we also have MARS

members who want to help improve MARS. If any of you reading this are interested in helping with the marketing committee, please let any of the officers or directors know. It is not a long-term commitment; you may participate as often or infrequently as you desire.

Another idea that has come out of the marketing committee is a caring committee. We have started to send out cards to family of members who have passed away. We have had discussions about other things we can do to help in this difficult time period. I was recently at a funeral for a friend of mine that passed away, and I became more aware that it is not easy for surviving spouses to easily continue in MARS. I brought that up at our next monthly Officers/Directors meeting, and we decided to implement a new policy starting immediately. We feel that it is important for MARS not to add to the burden of members passing away, so we decided that for the following year after a member passes, MARS will provide the surviving spouse a year of MARS membership free. Looking back, I wish that we had thought of this idea earlier, but it is certainly time for MARS to provide that little bit of caring.

We are having success in finding volunteers to write volunteer articles for the MARS STAR. This month's STAR will again include that feature, and we have another volunteer for the October MARS STAR. Thanks to Linda Cummiskey and to Raeanne Frazer for volunteering. As thanks for doing that, the MARS Association provides the volunteer organization a check for \$50. More importantly, it provides information about the volunteer organization and their goals to our MARS members, and provides other retirees information about organizations that they might be interested in.

Volunteers are the heart of this organization. They provide us the means to provide the MARS activities and services. We have other ideas that the marketing committee is currently considering. Those new activities will also require more volunteers for them to succeed. The officers and directors want to thank again all the present and future volunteers who help make MARS the great organization that it is.

I am really looking forward to the upcoming MARS activities and the rest of the year as our world gets back to almost normal. Thanks to all our members for bearing with us during this last year or so, and we are looking forward to the rest of this year.





Next Up

By Ken Marts

(martshouse2@aol.com)

We've hit mid-summer as evidenced by the long days and hotter temperatures. The pandemic is, for the most part, behind us and we're beginning to re-experience life outdoors with family and friends. MARS Associates is also enjoying getting together again as evidenced by our Happy Hour at the Platte River Bar and Grille (to recruit new members) and the annual Senior Banquet. We'll soon have our Rockies game in August and Annual Picnic at Clement Park in September to re-acquaint with old friends and develop new friendships. MARS Associates will continue to offer safe activities for all of us to enjoy as we move forward. Linda Duby works tirelessly planning these events and all of us on the Officers and Directors side welcome ideas from members for other activities you would like us to consider. Barb Sande has also been working with the team making suggestions for future activities in between all her postings on the MARS Associated Facebook page with everything Aerospace related. As with any organization, it is only as strong as its members and the contributions many make towards this success. I encourage each of you to consider how you could contribute in these activities either by leading an activity or providing input with ideas of some activities we could do as a group (bus trips to areas of interest for a train ride, Rocky Mountain National Park, as examples). We are also in the early stages of planning some informational discussions on arthritis and other topics of interest to members.

For recent retirees or those nearing the age of 65, Medicare is a big consideration. Lockheed Martin, through VIA, offers help in sorting thru the various plans and choices we have to consider. Using VIA, the company also contributes money into your Health Reimbursement Account (HRA) to defray some of your medical costs. MARS Associates (Bill Schrott) will be working with VIA to develop a presentation for members at a future date, if this is possible.

MARS Associates also provides several clubs for common interests. Many of you are already members of these clubs and have participated in their activities. I encourage those of you not yet participating in a club, to look at those being offered. The Dining Club provides opportunities to gather for casual lunches at favorite spots around the Denver area. The Hiking Club also provides opportunities for hikes in Colorado (usually Denver area sites) for people of all abilities. The MARS Associates website has access to each of the six clubs. Check them out and see which might interest you. You

may even decide a new club could be formed for the interest of members.

If any of you know retirees that are not members of MARS Associates, encourage them to check us out or give any of the Officers/Directors a call for a chat on the benefits of being a member. We look forward to talking with them, or you.

As always, please contact me if you have suggestions for improvements or items you would like to MARS Associates to consider. As the Marketing Committee Chair, I'm open to topics to discuss with the committee to bring forward to the other officers and directors at our monthly meetings. Your input is always appreciated.



Activities Updates

By Linda Duby

(lindaduby@comcast.net)

MARS is starting to have events again as we start to come out of the COVID restrictions and more people get vaccinated. By the time you receive this STAR, MARS will have held two events – a happy hour and the Luncheon Honoring Senior Members. Life is gradually returning to normal!

The happy hour was held on June 30 at the Platte River Bar and Grill in Littleton with approximately 35 people attending. We had several people attend who are not yet members and a few who have not yet retired. Several submitted their applications for membership.

The Luncheon Honoring Senior Members was held on July 14 at the Manor House at Ken Caryl. I will have more information on that event in the next edition of the STAR.

The next event will be the **Annual Picnic** being held on **September 8, 2021 at Clement Park**. The flyer is available in this edition of the STAR and on the website (<https://marsretirees.org>). The picnic will be in the shelters on the east side of the park near Columbine High School. Bennett's will be catering the food and MARS will provide beer and wine. The park has lifted all COVID restrictions so we are hoping for a great turnout for this outdoor event.

The picnic will have two payment/reservation options: (1) fill out the form on the flyer and mail it with your check to the P.O. Box, or (2) make your reservation and pay electronically with the STRIPE option. The link for

STRIPE is on the flyer and on the MARS website (<https://marsretirees.org>). We used the STRIPE option for the Luncheon Honoring Seniors and found that it is easy to use and it is a secure method of payment.

The final event for 2021 is the Holiday Celebration and there will be more information on that event in the October STAR.



MARS at the ROCKIES 2021

Our game and picnic this summer at Coors Field is planned for Wednesday, August 18, when the Rockies play the San Diego Padres. We have reserved 65 seats in section 145. As usual, these seats on the third-base side will be shaded by the Club level seating. The stadium is now at full capacity with no restrictions.

**** Deadline for signing up is August 1. ****

The flyer for this event is available on our MARS Associates website (<https://marsretirees.org>), our MARS Facebook page, or you may contact Linda Stearns at linda80120@comcast.net or telephone at 303-797-3557.



Business

By William Schrott
(wmschrott@msn.com)

I hope all is going well with all of you. I've been going through the COVID-19 escape by going on trips. We visited Fort Myers and Naples in Florida -- it was hot and humid. Then we went to my hometown of Buffalo New York. It was sure great to see the family after almost two years; we had ten days of sit, talk, and eat.

The next event I am looking forward to is the MARS picnic on September 8, 2021. I hope as many of you as possible can make it there. There will be a great meal and prizes.

I have invited many of our vendors to attend. The vendors attending so far include Red Rocks Credit Union, Delta Dental, Beta Health Dental, Kaiser Permanente, Hearing Rehab Center, and Aetna. This will give you a chance to talk face-to-face with representatives from these companies.

See you all soon. I do look better than the picture above.



Membership Report

By Carl Kaminski
(carlcolo@centurylink.net)

MEMBERSHIP STATISTICS

As of July 1, 2021, there are 1,234 MARS Associates members, including 639 seniors. We have a total of 48 new members who have joined MARS for the 2021 CY.

Please welcome the following new members who have joined this quarter:

Colorado

Aurora Andrew & Patricia Jost

Broomfield Michael Margulis

Denver Jerome & Julie Sobetski

Evergreen Patrick Langle

Highlands John & Bobbie Kever
Ranch

Lakewood Gregory & Suzanne Norris

Littleton Mary & Sheldon Brown, Robert Dawson,
Tom & Anne Henning, Jim Jaeckel, Patrick Marek,
Donald & Diana Missel, Kevin & Eileen Odle, David &
Kristin Schalla, Eric & Naoko Schmitz, Edwin Scholz,
Dennis Steinbeck

Lone Tree Jonathan & Gwen Feifarek

Morrison Lorraine & Patrick Persinger

Pagosa Springs Eric & Denise Fisk

Parker David Farin

Other States

Florida

Altamonte Gerald & Katie West
Springs

Nebraska

Benkelman Larry & Janice Tucker

International

Thailand

Chiangmai

Peter & Pranee Noyes

NEW MEMBERS

Do you know someone who recently retired from LM or ULA? First year membership in MARS is free for 2021. Direct them to the website for more information or have them contact one of the Officers or Directors.

Change of email address or phone number?

Given the rapidly changing environment we are all dealing with, it's more important than ever that we have current email and phone information for our members. Please remember to include the MARS membership team in your list of people to notify when you have a new phone number or email. We want to make sure all communications are timely.

MARS Associates

In Memoriam

By Norma Emerson

emer801@msn.com

Please contact me at the above e-mail address or at 303-303-646-1137 with information about the passing of a member, spouse of a member or other MM/LM retirees so they can be acknowledged in the In Memoriam section.

MARS Associates expresses our deepest sympathy in the loss of your loved one and a donation will be made to a charity chosen by the Officers and Board of Directors in their memory.

Members

Bowman, Joy (D: February 2021)

(Survived by Cal Bowman)

Littleton, CO

<https://tinyurl.com/cchmfy5p>

Brown, Sally (D: December 2020)

(Survived by Duane Brown)

Centennial, CO

<https://tinyurl.com/437c4nck>

Crouch, Monroe "Roe" (D: May 2021)

(Survived by Laura Crouch)

Lakewood, CO

<https://tinyurl.com/zvrpmjjk>

Crouch, Shirley (No date given)

(Survived by Donald Crouch)

Parkville, MD

No obituary published

DeBus, Dorothy (D: February 2021)

(Survived by William "Bill" DeBus)

Littleton, CO

<https://tinyurl.com/9pyd4km>

Fuhrmann, Beverly "Bev" (D: June 2021)

(Survived by Robert "Bob" Fuhrmann)

Parker, CO

No obituary published

Garrett, Virginia Jean (D: December 2020)

(Survived by Dwight Garrett)

Littleton, CO

No obituary published

Johancen, Thomas "Tom" (D: April 2021)

(Survived by Marlene Johancen)

Littleton, CO

<https://tinyurl.com/4na3k8yn>

Jones, Robert W. "Bob" (D: March 2021)

(Survived by Louise Jones)

Blue Eye, MO

No obituary published

Kellogg, Richard John (D: April 2021)

(Survived by Mary Jo Kellogg)

Littleton, CO

<https://tinyurl.com/8uxt33wf>

Leritz, Jean (D: May 2021)

(Survived by John Leritz)

Centennial, CO

<https://tinyurl.com/45ass2u9>

Mason, Lyle (D: April 2021)

(Survived by Mildred Mason)

Castle Rock, CO

No obituary published

McKee, Jay (D: May 2021)

Woodland, Park, CO

<https://tinyurl.com/s9mstju8>

Mellin, Joanne (D: March 2021)

(Survived by John Mellin)

Littleton, CO

No obituary published

Muhl, Frederick "Fred" (D: November 2020)

(Survived by Wilhemina "Billie" Muhl)

Huntsville, AL

<https://tinyurl.com/vrt4pwr>

Ong, David (D: January 2021)

(Survived by Mary Sue Ong)

Portland, OR

No obituary published

Rich, David F. "Dave" (D: May 2021)
Aurora, CO
<https://tinyurl.com/42d7f6j5>

Rombach, Jack (D: May 2021)
(Survived by Emma Rombach)
Littleton, CO
<https://tinyurl.com/4jhj6xf3>

Schneider, Edward "Ed" (D: January 2021)
Colorado Springs, CO
<https://tinyurl.com/e7mstmj>

Stevenson, Cheryl Ann (D: April 2021)
(Survived by Larry Stevenson)
Englewood, CO
<https://tinyurl.com/a2a3yybz>

Tedrow, Tom (D: May 2021)
(Survived by Angela Tedrow)
Littleton, CO
<https://tinyurl.com/hyhtts>

Ulrich, Robert "Bob" (D: Early 2021)
(Survived by Irene Ulrich)
Littleton, CO
No obituary published

Wanklyn, Charles "Keith" (D: April 2021)
Highlands Ranch, CO
<https://tinyurl.com/4rj8ypb7>

Wanklyn, Darlene (D: March 2021)
Highlands Ranch, CO
<https://tinyurl.com/s5exa8pv>

Non-Members

Browne, Edward "Ed" (D: April 2021)
Melbourne, FL
<https://tinyurl.com/a2zzck88>

Buza, Raymond "Ray" (D: May 2021)
(Survived by Cheryl Buza)
Centerville, VA
No obituary published

Fiandaco, Lucian "Lu" John (D: April 2021)
(Survived by Margaret Fiandaco)
Monument, Co
<https://tinyurl.com/ydw4n6yb>

Fosdick, George (D: March 2021)
Highlands Ranch, CO
<https://tinyurl.com/mpurj96x>

Hodge, John (D: May 2021)
(Survived by Kathleen Hodge)

Littleton, CO
<https://tinyurl.com/mx48ahtx>

Huck, Jacob (D: March 2021)
(Survived by Betty Huck)
Sedalia, CO
No obituary published

Hughes, David (D: May 2021)
(Survived by Julie Hughes)
Highlands Ranch, CO
<https://tinyurl.com/y6sf42ca>

Kilkenny, Peter (D: February 2018)
(Survived by Wendy Kilkenny)
Huntington Beach, CA
<https://tinyurl.com/dzbkvzv6>

Levenson, Bill (D: April 2021)
(Survived by Nancy Levenson)
Highlands Ranch, CO
No obituary published

Maginn, Madeliene (D: April 2021)
Denver, CO
<https://tinyurl.com/39bpjb2e>

Vosbeek, Robert "Bob" (D: June 2021)
Highlands Ranch, CO
<https://tinyurl.com/ry4fdbaf>

Weeks, John (D: March 2021)
St. Paris, OH
<https://tinyurl.com/cuewf5>

Woods, Virgie L. (D: June 2021)
Littleton, CO
<https://tinyurl.com/c6bfh9bp>

The MARS Associates Website

By Jim Kummer
(jkummer@comcast.net)

Each month a Site of the Month is posted on the MARS website. There is also a list of the previously websites posted -- some are educational, some are humorous, some provide useful information found elsewhere on the internet. The link to this list is on the main webpage, just below the current Site of the Month listings. You might find it entertaining to browse through the Site of the Month history - you may find some you've forgotten.

Some events and club activities are resuming -- watch the website for details found on the Welcome page, under the Club buttons, and in the "What's New ..." box. The MARS website provides members with the latest club status and event planning. We list a monthly Site of

the Month for the enjoyment of our members. Below are the most recent for the past quarter.

Apr – Income Tax Information:

Federal - www.irs.gov

Colorado State - www.colorado.gov/tax

Resources for [Free Tax Preparation](#)

May – Listen to Radio Stations All Over the World at [Radio Garden](#)

Jun – Look at this newly designed [Circular Map of the World](#)

Your website committee members welcome your suggestions for improving the website. It's been a while since we received any input. If you frequent websites you think would be of interest to our membership as websites of the month, you can email them to me at jkummer@comcast.net. Your website committee members are: Al Butvidas, Bob Knickerbocker, Linda Stearns, Duane "Smitty" Smetana, and Jim Kummer (Webmaster).



Colorado Adult Literacy Volunteer Opportunity

By Linda Cummiskey
(lcummiskey63@gmail.com)

I am engaged in an awesome volunteer opportunity provided by the Douglas County Libraries (DCL) that helps adults in our communities. I have participated for almost 1 year and I enjoy it very much!!

Note: This program is not limited to residents of Douglas County. The program coordinator, Tiffany Curtin (tcurtin@dclibraries.org), is very flexible with engaging volunteers, wherever we live.

The Adult Literacy Program with DCL serves adult learners preparing for their High School Equivalency Exams, and Adult English Language Learners. DCL pairs learners with volunteers from our community who are passionate about learning, teaching, and developing genuine connections. The program is learner centered: volunteer tutors work with the student to help the student develop and reach their learning goals as appropriate to the individual learner. The learning partners meet for a minimum of one hour per week for at least six months. Many develop lifelong connections. DCL provides materials and training (no tutoring or teaching experience is needed!).

Tutoring can be done virtually (via Zoom, etc.) or in-library (if COVID restrictions allow).

There is a real need for volunteers; for example, my learner was on a waitlist for several years.

My learner is improving her English skills, and I've enjoyed learning about her native country. I have also gained an appreciation for how difficult it is to learn English as an adult. Please contact Tiffany Curtin if you are interested in exploring this opportunity!

Historian Corner

By Barb Sande

barbsande@comcast.net

Program Profile

This issue profiles the first Space Shuttle launch (*Columbia* – STS-1) in recognition of the 40th anniversary of that milestone event on April 12, 2021. The profile is primarily about the actual mission, significant events and the major anomalies that occurred. At the end of the profile are resources (links) used for this article as well as links to other historical documents about creating and designing the Space Shuttle program.

STS-1 Mission Overview

Launch: 04/12/1981 12:00:03 UTC LC-39A, KSC, Florida
Landing: 04/14/1981, 18:20:57 UTC, Edwards Air Force Base, California, Runway 23
37 orbits completed in 2 days, 6 hours, 20 minutes, 53 seconds
Orbiter Vehicle Designation (OV-102): *Columbia*
Mission Designation: STS-1
Insertion Altitude: 145 nautical miles at -25.6 degrees
Perigee: 152 nautical miles
Apogee: 172 nautical miles
Inclination: 40.3 degrees
Orbital period: 89.4 minutes
Launch Window Duration: 4.7 hours
Crew: Commander John W. Young, Pilot Robert L. Crippen

Connection to Lockheed Martin/ULA: The major contributions of our heritage companies to the Space Shuttle program are noted in appropriate points the profile and listed at the end of this profile, after the crew biographies and before the links to references.



Commander John Young and Pilot Bob Crippen in *Columbia*
Photo Credit: NASA

A New Era Dawns in American Space Travel

Early on the morning of April 12, 1981, an estimated crowd of more than 600,000 spectators gathered near Kennedy Space Center, Florida, and cheered as the first launch of American astronauts in six years roared and crackled into the dawn sky at 7:00 am EST. STS-1 (Space Transportation System flight 1) was finally on its way to Earth orbit in a demonstration of new and unprecedented space technologies. These new technologies included the Rockwell-designed sophisticated winged, reusable orbiter vehicle (OV) that would be launched vertically and then re-enter and land on designated runways ("the spaceplane"); recoverable solid rocket boosters; and a huge expendable cryogenic oxidizer/fuel storage and transfer system known as the External Tank (built by Martin Marietta) for the SSMEs (Space Shuttle Main Engines), which also carried the structural load of the orbiter during ascent. The OV was designed to carry as many as seven astronauts and had a large payload bay (60 feet by 15 feet). The STS-1 launch coincidentally occurred exactly 20 years after the first human spaceflight (Yuri Gagarin, Vostok 1, USSR); the first launch attempt was on April 10, which was scrubbed at T-18 minutes when the IBM System/4 Pi computers on-board *Columbia* failed to provide the correct timing to the Backup Flight System. That technical problem required a software update, delaying the launch 48 hours. STS-1 was the only human space system (so far) that did not have an unmanned test flight to space prior to the first crewed mission, although drop tests of the orbiter systems for landing operations were performed with OV-1 (*Enterprise*).

The Veteran, the Rookie and their Objectives

The 2-person crew of STS-1 was commanded by the veteran astronaut and moonwalker John Young; STS-1 was his fifth space mission and his fourth distinct launch vehicle/spacecraft configuration (Gemini, Apollo Command Module, Apollo Lunar Module, STS). The pilot position was assigned to rookie Robert Crippen, who

was first assigned to the MOL (Manned Orbiting Laboratory) program, then became part of Astronaut Group 7 after MOL was canceled. The backup crew was Commander Joe H. Engle and Pilot Richard H. Truly, who both flew on STS-2. Biographies of both prime crew members are provided later in this profile.

The mission objectives for STS-1 were to accomplish a safe ascent into orbit and return to Earth for a safe landing of the Orbiter and crew. The only payloads carried on the mission were a Development Flight Instrumentation (DFI) package, with sensors and enhanced instrumentation and an Aerodynamic Coefficient Identifications Package (ACIP) pallet, containing equipment for recording temperatures, pressures and acceleration levels. The crew also had on board Extravehicular Mobility Units in the event that an emergency spacewalk was required. Operation of the OV required 22 manuals weighing a total of 63 pounds, due to the complexity of the controls, including 2,214 switches and displays in the cockpit (three times as many as the Apollo Command Module). One has to admire the evolution of spaceflight with the sleek design seen recently in the SpaceX Crew Dragon crew cabin.

Ascent to Orbit

The launch of STS-1 was most impressive to the observers and the viewers watching on television. That group of viewers included a packed house in the Engineering building cafeteria at the Martin Marietta Waterton facility (including yours truly; many people came in early to see the launch). The Morton Thiokol SRBs provided a combination of nearly 6 million pounds of thrust (vacuum) and this was also the first use of solid rockets for human spaceflight; the SRBs were the source of the "crackling" noises heard during ascent. The SRB thrust was coupled with three Rocketdyne RS-25 liquid cryogenic SSMEs fed by tanks in the ET that created an additional thrust at lift-off of 1.25 million pounds. These two propulsion systems were required to lift a typical system stack weight of 4.5 million pounds. The SSMEs ignited first, at T-10 seconds during the countdown. At T-0, the SRBs ignited after the SSMEs were or above 90% rated thrust and the explosive bolts were detonated simultaneously, releasing the stack from the pad. John Young observed that they could clearly hear the roar of the SSMEs, then the SRB ignition "kick" felt like a catapult launch off an aircraft carrier! I was fortunate enough to see an early shuttle launch (STS-4) in person from the NASA causeway on June 27, 1982 and it was most impressive, although not quite as powerful a rocket as the Saturn V; I was also blessed to witness the launch of Apollo 15 in July, 1971 (that's a story for the next MARS STAR!). I also saw other STS launches and landings over the years supporting Titan activities at CCAFS or while on vacation in Florida.

After clearing the tower, STS-1 began a right roll to an azimuth of 067 degrees (True) to help achieve the orbital inclination of 40.3 degrees. Simultaneously, the stack pitched downward to reduce loading on the OV wings. Control was passed from the KSC launch team to Mission Control in Flight Control Room 1 in Houston, under the direction of the Silver Team Flight Director (Neil Hutchinson). Astronaut Dan Brandenstein functioned as CAPCOM (Capsule Communicator, usually an astronaut). Apollo program veteran Gene Kranz was in the background as the Mission Operations Director on STS-1.



STS-1 Clears the Tower, April 12, 1981
Photo Credit: NASA

The ascent events occurred as follows (in Mission Elapsed Time or MET):

- 1) Max Q (at Mach 1.06) occurred at 1:06 minutes MET; SSMEs were throttled down before Max Q to 65% thrust to reduce the aerodynamic stress. The wind-corrected value at Max Q was 4.21 pounds per square inch (predicted was 4.0 psi and the limit was 4.31 psi).
- 2) SRB separation occurred at 2:117 MET at an altitude of 174,000 feet. The SRBs performed better than planned, lofting the trajectory and separating 9,200 feet higher than predicted. The SRBs deployed parachutes upon descent for recovery at sea by one of two specially-rigged NASA ships (*Freedom Star*, *Liberty Star*).
- 3) MECO (Main Engine Cut-off) occurred at 8:34 MET at an altitude of 388,000 feet.
- 4) The ET was jettisoned at 8:52.1 MET and broke up during re-entry, impacting the Indian Ocean. This ET and the one used on STS-2 were painted white; the paint was considered unnecessary and added weight (over 350 pounds) that could be eliminated. Missions starting with STS-3 had no paint on the ET.
- 5) Burn 1 of the two OMS (Orbital Maneuvering System) hypergolic AJ10-190 engines (provided by Aerojet) occurred at 10:34 MET and lasted for 86.1 seconds. Young and Crippen were surprised at how loud the OMS engines were during operation ("it sounded like a big cannon just fired" according to Bob Crippen). Each OMS

engine was capable of 6,000 pounds of thrust using MMH (monomethylhydrazine) and N2O4 (Dinitrogen Tetroxide) and they could be reused for 100 missions or 1,000 starts. The OMS was co-housed with the aft Reaction Control System (RCS) engines, which were also hypergolic.

- 6) Burn 2 of the two OMS engines occurred at 44.02 MET for 74.8 seconds. This resulted in an orbit of 152.7 nm by 153.9 nm. The intended orbit was supposed to be precisely 150 nm circular. The reason for the subtle orbital change is explained in the section about the concerns for the Thermal Protection System.

Columbia Achieves Orbit

Once in orbit, Young and Crippen safed their ejection seats and unstrapped to start moving around the very roomy crew quarters, as compared to previous programs other than Skylab (Mercury, Gemini, Apollo). The next critical event was the opening of the payload bay door, which was essential to cooling of the OV via the door's space radiators. Failure to open the door would require an abort of the mission by orbit number 5. Fortunately, the door opened, but the crew observed that there was damage to the TPS tiles on the OPS pods, including several missing tiles; images of this damage were relayed to the ground.

The crew changed out of their ejection suits and began a series of systems tests of the OV. All of the mission objectives were accomplished, including Crew Optical Alignment Sight (COAS) calibration, star tracker performance, IMU (Inertial Measurement Unit) performance, manual and automatic RCS testing, radiation measurements, propellant cross-feeding for the OMS, hydraulics functioning, fuel cell purging and photography.

Two burns of the OMS engines, at 6:20:46 MET and 7:05:32 MET, raised the final orbit to 170.2 nm by 170.3 nm; the two burns demonstrated the single-engine cross-feed capability of the OMS system. The crew complained about the cold temperature conditions on-board during the first sleep period, which was alleviated by doing some temperature adjustments.

While conducting their on-orbit tasks, Crippen took time to pay tribute to three pad personnel who lost their lives after an incident on March 19, 1981 while processing *Columbia*. During a countdown test, a pure nitrogen atmosphere was introduced in the aft compartment of the OV to reduce the danger of explosion. The pad workers were given clearance to return to the work on the OV before the nitrogen was purged (a procedural error). John Bjornstad, Forrest Cole and Nick Mullen entered the compartment and lost consciousness. They were seen by another worker who tried to help, but also passed out; a security guard was alerted and another pad crew worker went in to help. The security guard,

with an air pack, removed the five men from the compartment. Security procedures delayed the ambulances and Bjornstad died at the scene, Cole died the next day, and Mullen died on April 11. A three-month inquiry was held to ensure that pad safety procedures and communications were improved.

During the second day of the mission, the astronauts received a congratulatory phone call from Vice-President George H.W. Bush. President Reagan had sent his best wishes prior to launch but was still recovering from his attempted assassination that took place on March 30, 1981. The crew settled in for the second sleep period, waking earlier than usual because of the complex series of events about to unfold during re-entry and landing.

Worries About the Thermal Protection System

One of the biggest dramas of the short STS-1 flight revolved around the silica heat shield tiles. Previous spacecraft re-entering Earth's atmosphere used heavy ablative heat shields that were planned to be used once and burned off during re-entry. The Shuttle OV design required a light, reusable heat shield system, limiting designs to a few cutting-edge technologies that were available in the early 1970s. Before the stacked system finally launched, OV-2 (*Columbia*) had over two years of delays at Rockwell and in the Orbiter Processing Facility (OPF) at KSC having many of the fragile Thermal Protection System (TPS) heat shield tiles replaced, often more than once.

The TPS was mission critical and relied on several different technologies; the High-Temperature Reusable Surface Insulation (HRSI) tiles were among the most problematic subsystems before the long-delayed launch of STS-1. 20,548 of these HRSI tiles, manufactured by Lockheed Missiles and Space, covered the landing gear doors, the External Tank (ET) umbilical connection doors, and the orbiter's underside surfaces and each one took as long as 40 hours to place on the OV. Each HRSI tile was serialized and had a specific location on the orbiter and was composed of pure porous silica (Li-900) with a coating of Reaction Cured Glass to increase the heat sink properties. The tiles were glued to strain pads, which were then glued to the OV structure using RTV (room temperature vulcanizing) adhesive; they would fall off or were easily damaged during handling and were expected to withstand temperatures from -454 degrees F (space) to 2,300 degrees F (re-entry temperatures).

Low-Temperature Reusable Surface Insulation Tiles (LRSI) were used on the upper fuselage and parts of the OMS (Orbital Maneuvering System) Pods. Reinforced Carbon-Carbon (RCC) was used on the nose cap, landing gear doors (forward) and the orbiter wing leading edges due to its ability to withstand temperatures greater than 2,300 degrees F.



Example of an HRSI TPS Tile

Photo Credit: Science Museum of London, 1980

This last system (RCC) was breached on the left leading edge wing by foam debris from the ET during the launch of STS-103 in January, 2003; this breach allowed for super-heated gases to cause the complete disintegration of the OV (*Columbia*) with the corresponding loss of the seven-person crew during re-entry on February 1, 2003.

The crew was unaware at the time of lift-off, but the mission directors and senior leadership at NASA were so concerned about the integrity of the heat shield tiles that they planned on an subtle orbital change to have the OV in place to be imaged by a classified spacecraft that was in another orbit (and also to take into account the 48-hour launch delay); this orbital change required a 4-second delay of T-0 into the window. As noted previously, the LRSI tiles on the OMS pods were damaged, exacerbating the concerns for the more critical HRSI tiles. The results of the imaging were not available for public release, nor were the details discussed publicly. However, the imaging apparently did relieve some of the concerns that the OV could burn up on re-entry.

Columbia Returns to Earth

The Crimson Flight Team, led by flight director Don Puddy and CAPCOM Joe Allen came on-board in Houston to support the preparations for the de-orbit burn and re-entry. The first critical event was the closing of the payload bay doors; Crippen was trained to do a one-person EVA if necessary to manually winch the doors closed if the power system had failed. Fortunately, no problems occurred and the crew strapped into their ejection seats after ensuring all cabin switch positions were in the proper state.

Meanwhile, at Edwards Air Force Base, a crowd of more than 225,000 spectators was gathering, overwhelming the access roads and crowd control measures. I moseyed over that day to the Waterton Engineering

building cafeteria (I worked in the same building for Titan Airborne Electrical Design) and joined the huge crowd there waiting to see the landing on TV. JSC (Johnson Space Center) pilots Charlie Hayes and Ted Mendenhall were airborne over Edwards, checking weather conditions while flying one of the Shuttle Training Aircraft (STA), a modified Grumman Gulfstream II that was used to evaluate approach and landing conditions for returning shuttle missions. The OV's were essentially very heavy gliders, with no atmospheric engines, and each landing was a one-shot deal, with no opportunity to "go around" and try again. The fleet of four STAs would simulate the landing conditions so that the optimal landing approach could be relayed to the crew (STS-1 was mostly an automatic de-orbit and landing).

On-board *Columbia*, Auxiliary Power Units (APUs) 2 and 3 were started to provide flight control hydraulic pressure. On the 37th orbit over the southern Indian Ocean, the two OMS engines did a 160-second de-orbit burn, ensuring atmospheric capture of the OV close enough to the landing site to have sufficient energy for the controlled glider landing, while also ensuring that the energy dissipation would not exceed structural capabilities. Young slowly pitched *Columbia* up to the nose high entry attitude; he and Crippen armed their ejection seats during this pitch around. APU 1 started about 30 minutes later, then shortly afterwards *Columbia* entered a 21-minute communications blackout (a combination of ionization and lack of ground station coverage across the mid-Pacific). Entry Interface (EI) was reached over the eastern Pacific Ocean 5,040 miles from Edwards at a speed of 17,550 mph. EI is nominally a geodetic altitude of 400,000 feet.

Most of this first OV re-entry was flown automatically. The initial angle of attack of 40 degrees had to be maintained through the most severe aerodynamic heating, after which it was gradually reduced. *Columbia* also had to maneuver "cross-range" over 362 miles of its orbital ground track to reach the planned landing site. When air density reached around 12 lb/sq ft, a roll into a right bank was performed (at a speed in excess of Mach 24 and at an altitude of 255,000 feet). Automatic roll reversals to control the energy dissipation rate and cross-range steering were performed at Mach 18.5 and Mach 9.8. Young and Crippen were able to observe the coast of California as *Columbia* crossed near Big Sur at 135,000 feet and Mach 8. The Mach 4.8 and Mach 2.8 roll reversals were automatically initiated and manually completed by Young. The last RCS firing took place at an altitude of 56,000 feet (lower than desired due to a predicted risk of combustion chamber explosion).

Young again took manual control for the remainder of the flight as the OV went subsonic, approaching the critical Heading Alignment Circle (HAC) near Edwards. A wide left turn was flown to line up with Runway 23 (lake

bed) while the *Chase 1* T-38 (with astronauts Jon McBride and "Pinky" Nelson) joined the formation. The main gear touched down on runway 23 at 211 mph equivalent airspeed at 10:21 am PST on April 14, 1981, about ½ mile further down the runway than planned and slightly slower. John Young radioed the following as they rolled to a stop: "This is the world's greatest all-electric flying machine. I'll tell you that. That was super!". The crew waited for hazardous operations to give the green light (due to the hypergolics on-board the OMS and RCS) before descending from the OV and giving it a once-over and "kicking the tires". *Columbia* was returned to KSC atop one of the Shuttle Carrier Aircraft (modified Boeing 747s). After processing and anomaly corrective actions were implemented in the OPF in the VAB, STS-2 was rolled out and launched on November 12, 1981. The STS program was now underway!



STS-1 Landing, Edwards AFB, April 14, 1981
Photo Credit: NASA

Significant Anomalies on STS-1

Approximately 70 anomalies were recorded during launch, orbital operations, and entry/landing during the STS-1 flight. A link to the full list of anomalies is provided at the end of the profile. The most significant anomalies are noted below:

1. Probably most significantly along with the TPS concerns, dynamics engineers seriously underestimated the amount of noise and vibration just after T-0. Shock waves from the SRBs were deflected up into the OV's tail section, leading to concerns for structural damage (and actual damage, which was discovered after the flight). An improved water suppressant system was later installed on LC-39A before the STS-2 mission to dampen the vibrations. This overpressure deformed the FRCS (forward RCS) strut, causing it to fail at the Z-point. The same overpressure wave also forced the "body flap" (an extension on the OV underside that helps control pitch during re-entry) into an angle that *should* have ruptured the hydraulic system, nullifying

any control authority during re-entry. Young stated at a later review that if they had known about the damages, they likely would have ejected during ascent; he was a skeptic about being able to survive that ejection.

2. During ascent up to SRB separation, Crippen reported seeing "white stuff" (likely paint) coming off the ET and splattering the windows. The white paint only lasted one more flight before being removed from the ET thermal foam.
3. As noted in previous paragraphs, the crew observed significant damage to the thermal protection tiles on the OMS/RCS pods at the OV's aft end. Post-flight inspection of *Columbia* confirmed that 16 undensified or low-temperature tiles near the OMS pods were lost during ascent. Design improvements to the TPS were an on-going science project during the 30-year course of the shuttle program.
4. *Columbia*'s aerodynamics at high Mach numbers during re-entry differed significantly from pre-flight estimates. A misprediction of the location of the center of pressure caused the computer to extend the body flap by sixteen degrees rather than the expected eight or nine degrees. Also, the first roll maneuver resulted in lateral and directional oscillations that created side slip angles up to 4 degrees (twice predicted). This was due to the moments created by yaw RCS jet firings.
5. The ET tumble system after separation did not work.
6. Both radar altimeters lost lock at 75 feet above the ground (no valid data after that point).
7. The strike plate next to the forward latch of *Columbia*'s ET door was melted and distorted during re-entry. This was attributed to an improperly installed tile adjacent to the plate.
8. The Payload Bay Door (PLBD) closure overlap was more than predicted. It was in excess of 3 inches at the number 12 hatch location; maximum design capability was 4 inches.
9. Cabin temperature controllers did not maintain selected temperatures.
10. The nose gear door thermal barrier fell off during landing gear deployment and was found 1.5 miles before touchdown point.
11. The right-hand main landing gear door buckled due to excessive heating during re-entry. John Young claimed he was unaware of this major anomaly until many years after the flight.
12. Three pad crew members were killed by suffocation due to exposure to 100% nitrogen in the OV engine compartment on March 19, 1981. A separate review board was convened for that incident and procedural corrective actions were implemented.

Forty Years Later...

The space shuttle program ended ten years ago with the 135th mission, STS-135 (*Atlantis*), which launched on July 8, 2011 and landed at KSC on July 21, 2011. The program had enormous costs, both operationally and from a loss of OVs and crew due to the high risks

associated with the stacked system design (*Challenger*, *Columbia*, 14 astronauts, several lives lost in ground incidents, including the three referenced in this profile who died just before the STS-1 launch). Many milestones were accomplished by the shuttle program, including deployments of Spacelab, major elements of the International Space Station, key interplanetary and observational payloads (Magellan, Galileo, Ulysses, Hubble Space Telescope, Chandra X-Ray Observatory) and several other NASA, Commercial and DoD payloads. The times have changed and we have now moved into the era of creative disruptors in the space business, like SpaceX, Sierra Nevada (Dreamchaser is another spaceplane concept), Blue Origin, Electron Space, Relativity and Virgin Galactic and NASA plans are still in work (as of mid-2021) to launch the Orion program using the Artemis launch system. An interesting summary of the shuttle program by mission is included in the links. Travelers interested in seeing the remaining OVs can view *Atlantis* at KSC, *Discovery* at the Udvar-Hazy Center near Washington, D.C., *Endeavour* at the California Science Museum, and the drop vehicle *Enterprise* at the Intrepid Air and Space Museum in New York.



STS-1 and STS-135 Crews Meet in 2011
From Left: Doug Hurley, Robert Crippen, John Young, Chris Ferguson, Sandy Magnus, Rex Walheim
Photo Credit: NASA

John Young Biography

John W. Young was born in San Francisco, California on September 24, 1930. His father, William Young, lost his job during the Great Depression and the family moved to Georgia in 1932, then on to Orlando, Florida, in 1936. His mother was diagnosed with schizophrenia and was committed to the Florida State Hospital. John and his brother Hugh were left in the care of a housekeeper when their father joined the Navy during WWII; the father returned after the war and managed a citrus company. John attended Orlando High School, graduating in 1948.

Young received a Navy ROTC scholarship to the Georgia Institute of Technology, completing a midshipman cruise

aboard the USS *Missouri*, where he worked alongside future Apollo 10 crewmate Tom Stafford. He graduated second in his class with a B.S. in Aeronautical Engineering and was commissioned in the US Navy in 1952. In 1953, he received orders to go to flight school at Naval Air Station Pensacola and was selected for helicopter training, but also flew fighter aircraft. He received his aviator wings in December, 1954 and was assigned to Fighter Squadron 103 at NAS Cecil Field and was deployed with the Sixth Fleet on the USS *Coral Sea*. He returned home to enroll in the Naval Test Pilot School, graduating second in his class again and working alongside future astronaut Jim Lovell.

In September 1962, Young was selected to join NASA Astronaut Group 2 and he moved with his family to Houston. He was selected as the pilot of Gemini 3, which was commanded by Gus Grissom. Gemini 3 launched on March 23, 1965; Grissom and Young successfully conducted orbital maneuver tests and part of the biological experiments and re-entered on the third orbit. The Gemini capsule landed 52 miles short of its target area and the crew waited more than 30 minutes for the rescue helicopters. Young gained infamy for having smuggled a corn beef sandwich on-board during the flight (the House Appropriations Committee actually held a hearing on that "incident").

Young and Mike Collins were assigned as the Gemini 10 Commander and Pilot in January, 1966. The primary mission of Gemini 10 was to dock with the assigned Agena target vehicle, a failed objective from the Gemini 8 and 9 missions. The Agena and Gemini 10 launched on July 18, 1966 and the crew was successful in rendezvousing and docking with the target vehicle. Using the Agena's engines, Gemini 10 maneuvered to a 180 by 470 mile orbit, setting a new altitude record, they then rendezvoused with the Gemini 8 Agena and immediately set another record of 475 miles. After returning to a lower orbit, Collins performed a stand-up EVA in the door of the capsule. After undocking from their own Agena, they returned to the Gemini 8 Agena and performed another successful rendezvous; Collins conducted an EVA to the nearby target vehicle and retrieved a micrometeorite experiment package. Re-entry on July 21 was in the western Atlantic Ocean, very close to the recovery vehicle. If I am still the historian in a few years, I hope to write the detailed stories of the Gemini missions for their 50th anniversaries (and that would include the Titans!).

Young, of course, had great success on the Apollo program. He was the command module pilot on Apollo 10, the "dress rehearsal" for the lunar landing that took place in May, 1969. He then commanded the Apollo 16 mission in April, 1972. The Apollo 10 mission was profiled in a MARS STAR in 2019 and the Apollo 16 mission will be examined in a MARS STAR Historian Corner profile for its 50th anniversary in 2022.

In January, 1973, Young was made Chief of the Space Shuttle Branch of the Astronaut Office. He then succeeded Alan Shepard as Chief of the Astronaut Office. He flew T-38 chase planes for several of the Approach and Landing Tests of the *Enterprise*. He resigned with the rank of Captain from the USN in 1976. In 1978, Young was assigned as Commander of the first STS mission, which was delayed until 1981 because of the TPS problems described elsewhere in this article. This energetic and driven astronaut was not done with space travel after STS-1, though. He also commanded STS-9 (*Columbia*) in November, 1983 with Brewster Shaw, Owen Garriott, Robert Parker, Byron Lichtenberg and West German Astronaut Ulf Merbold. This mission was the first to carry the Spacelab module into orbit.

Young remained as chief of the Astronaut office and was very critical of NASA management following the *Challenger* disaster in January, 1986; he testified before the Rogers Commission and suggested improvements to the system safety program. He was scheduled to fly as the Commander of STS-61-J to deploy the Hubble Space Telescope, but that mission was postponed for several years. He was replaced as Chief of the Astronaut Office in 1987 and he believes his reassignment to the Engineering, Operations and Safety Directorate was because of his public criticisms of system safety. He worked on several safety improvements, then was assigned in 1996 to be an Associate Technical Director for the development of the MIR and ISS programs. Young retired from NASA on December 31, 2004. He worked as a public speaker and advocated the importance of asteroid impact avoidance, colonization of the Moon, and climate engineering. His autobiography "Forever Young" was published in 2012, co-authored by James Hansen.

Young married Barbara White from Savannah, Georgia in December, 1955 and they had two children and two grandchildren. They were divorced in 1971 and he married Susy Feldman and resided in Houston. One of the most admired pilots, astronauts and administrators in NASA's history passed away at 87 on January 5, 2018 of complications from pneumonia and he was interred at Arlington National Cemetery. He received many honors and awards during his lifetime, along with inductions into several Aviation and Space Halls of Fame; if you ever drive from Orlando airport to Walt Disney World, you likely will be on Florida Turnpike 423, now named the John Young Parkway.

Robert L. Crippen Biography

Robert Crippen was born in Beaumont, Texas on September 11, 1937. After graduating from New Caney High School in New Caney, Texas in 1955, he enrolled at the University of Texas at Austin and received a B.S. degree in Aerospace Engineering. He was commissioned in the Navy through the Officer Candidate

School program at Naval Air Station Pensacola. He was a naval aviator from mid-1962 until the end of 1964, then enrolled in the USAF Aerospace Research Pilot School at Edwards AFB. In October, 1966, he was selected for the USAF Manned Orbiting Laboratory (MOL) program as part of the second group of astronauts for that military program.

The MOL program was a joint venture between the USAF and the National Reconnaissance Office. Using a modified Gemini B capsule for the crew and Titan IIIM launch vehicle, the two-person crews would spend up to 40 days in polar orbit in the MOL Space station performing a variety of functions, including classified reconnaissance. An early test flight was conducted with a Titan IIIC on November, 3, 1966, with a refurbished Gemini spacecraft. The program was canceled in June, 1969, by President Nixon with much of the work already done to facilities at SLC-6 at VAFB and in the development of the stacked systems. Folks that worked at Martin Marietta during this time have told stories of having drawings done and released, only to have it all yanked away because of budget cuts. Crippen, along with several other MOL astronauts, became part of NASA Astronaut Group 7 in September, 1969.

Crippen participated in the Skylab Medical Experiment Altitude Test, a 56-day mission in 1972 in a vacuum chamber, examining how crews would handle long-term minor medical emergencies. Crippen also functioned as a CAPCOM for the Skylab and Apollo-Soyuz missions; he then moved on to support of the Approach and Landing (ALT) tests for Space Shuttle *Enterprise*. He was then assigned as pilot for STS-1.

After STS-1, Crippen went on to command three more shuttle missions. STS-7 (*Challenger*) was launched on June 18, 1983 and the crew deployed two commercial satellites and performed several experiments before landing on June 14. STS-41-C (*Challenger*) launched on April 6, 1984 and landed on April 13; this mission deployed the Long Duration Exposure Facility and the crew retrieved and repaired the Solar Maximum Mission. The flight also tested the Manned Maneuvering Units (MMUs) for the first time. STS-41-G (*Challenger*) launched on October 5, 1984 and deployed the Earth Radiation Budget Satellite and performed scientific experiments, landing on October 13, 1984.

After STS-41-G, Crippen was named commander of STS-62-A, which would have been the first shuttle launch from SLC-6 at VAFB, scheduled for July, 1986. That mission and all other VAFB shuttle operations were canceled after the *Challenger* disaster in January, 1986. Crippen probably felt like he was part of the "curse" of SLC-6, between the MOL program and this turn of events. He was part of the Mishap Review Board for the Challenger accident; starting in 1987, he was the Deputy Director of Shuttle Operations at KSC, then served as

Director of the Space Shuttle program at NASA headquarters from 1990 to 1992, returning to KSC to be the site director until 1995.

Crippen left NASA in 1995 and was hired as the Vice President of Lockheed Martin Information Systems, leaving that job in 1996 to become President of Thiokol Propulsion, retiring in April 2001. He was married to Virginia Hill in 1959 and they had three daughters together and were later divorced; in 1987 he married Pandora Puckett, the first female lead Orbiter Project Engineer on the Space Shuttle Program. He is retired to private life in Florida and also had many awards and halls of fame inductions through his illustrious career.

Lockheed Martin Heritage Company Contributions

The largest subsystem for the STS stack was the External Tank, built by Martin Marietta/Lockheed Martin in Michoud, Louisiana. 135 external tanks were delivered and used in operations; the tank for STS-51-L (*Challenger*) did not achieve orbit and foam debris from the tank for STS-103 resulted in damage to the TPS on the OV (*Columbia*), resulting in loss of the OV during re-entry. The ET provided about 180,000 pounds per minute of liquid hydrogen and 67,000 pounds per minute of liquid oxygen to all three SSMEs. The ET was 153.6 feet long, with a diameter of 27.6 feet.

Lockheed Missiles and Space Systems designed and produced the TPS silica tiles used on the OV (see the section on the TPS in the profile).

Lockheed Martin and Rockwell/Boeing joined forces to form United Space Alliance in 1995, which became responsible for processing the shuttle fleet and ISS components at JSC and KSC. The joint venture was disbanded in 2019.

NOTE: A search for a complete list of subcontractors and suppliers for the Space Shuttle program was unsuccessful, with promising links through the NASA portals met with "denied access" results.

Resources and Links

NASA References

The Space Shuttle Decision

<https://history.nasa.gov/SP-4221/sp4221.htm>

History of the Space Shuttle (NASA Portal – some links are not available)

<https://history.nasa.gov/shuttlehistory.html>

The Space Shuttle and Its Operations

<https://www.nasa.gov/centers/johnson/pdf/584722mainWings-ch3a-pgs53-73.pdf>

Processing the Shuttle for Flight

<https://www.nasa.gov/centers/johnson/pdf/584723mainWings-ch3b-pgs74-93.pdf>

Space Shuttle Missions Summary

<https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/reference/TM-2011-216142.pdf>

STS-1 Anomaly Archive

<https://web.archive.org/web/20061007035617/http://www.jsc.nasa.gov/news/columbia/anomaly/STS1.pdf>

The External Tank

https://www.nasa.gov/returntoflight/system/system_ET.html

STS-1 40th Anniversary Histories

<https://www.nasa.gov/subject/3299/sts1/>

Space Shuttle Era Facts

https://www.nasa.gov/pdf/566250main_2011.07.05%20SHUTTLE%20ERA%20FACTS.pdf

Wikipedia Articles

Space Shuttle Program

https://en.wikipedia.org/wiki/Space_Shuttle_program

STS-1

<https://en.wikipedia.org/wiki/STS-1>

Space Shuttle Thermal Protection System

https://en.wikipedia.org/wiki/Space_Shuttle_thermal_protection_system

John Young Biography

[https://en.wikipedia.org/wiki/John_Young_\(astronaut\)](https://en.wikipedia.org/wiki/John_Young_(astronaut))

Robert Crippen Biography

https://en.wikipedia.org/wiki/Robert_Crippen

On This Date in History

This section has milestones retrieved from publicly available information for LM, ULA and heritage programs from 10 to 60 years ago (2011, 2001, 1991, 1981, 1971, 1961). Delta launches prior to the formation of ULA, unless it included an LM or heritage company payload or upper stage, are not listed. No classified programs are identified, even if the program is now considered unclassified, with the exception of the Discoverer program (Corona). The events reflect milestone activity in the quarter previous to the release of the MARS STAR -- where appropriate, key press releases are also included; significant milestones are in bold. The list is not intended to be all-inclusive due to historical record inaccuracies. Occasionally, a major space milestone not accomplished by any of our heritage programs will be included due to its significance.

Events in April (10 to 60 years ago)

04/11/2011: Lockheed Martin Press Release: Lockheed Martin ships Juno Spacecraft to NASA

04/14/2011: USA-229 launched by ULA Atlas V-411 from SLC-3E, VAFB

04/07/2001: LM 2001 Mars Odyssey launched by Delta II 7925-9.5; SLC-17A, CCAFS; As of 6/10/2021, Mars Odyssey is still operational

04/19/2001: STS-100 (*Endeavour*) launched, LC-39A, KSC; 7-person crew, ISS mission with Canadarm2 and Raffaello module

04/06/1991: STS-37 (*Atlantis*) launched, LC-39B, KSC; 5-person crew, deployed Compton Gamma Ray Observatory

04/15/1991: Lockheed UGM-133 Trident II launched, USS *West Virginia*, ETR

04/18/1991: MM MGM-134 (Midgetman) launched, TP-01, VAFB

4/18/1991: Yuri 3H launched by GD Atlas I, LC-36B, CCAFS – **FAILURE** – upper stage turbopump

4/28/1991: STS-39 (*Discovery*) launched, LC-39A, KSC; 7-member crew, DoD experiments

04/01/1981: Lockheed UGM-96 Trident 1 launched, USS *Simon Bolivar*, ETR

04/07/1981: Three MM MGM-31A Pershings launched, LC-16, CCAFS; incomplete information

04/12/1981: STS-1 (*Columbia*) launched, LC-39A, KSC; first shuttle flight, subject of the program profile in this MARS STAR

04/24/1981: Classified program launched by MM Titan III (34)B, SLC-4W, VAFB

04/05/1971: LAR-1 launched by GD Atlas E/F, ABRES-A-1, VAFB

04/19/1971: Salyut 1 launched by Proton-K, Baikonur 81/24, USSR – first manned space station (item of historical significance)

04/22/1971: Classified program launched by MM Titan III(23)B, SLC-4W, VAFB; final flight of Titan III(23)B

04/08/1961: Discoverer 23 launched by Thor DM-21 Lockheed Agena B, LC-75-3-5, VAFB

04/11/1961: Lockheed UGM-27 Polaris A2 launched (two), LC-29A, CCAFS; **FAILURES**

04/12/1961: VOSTOK-1 launch, Baikonur 1/5, USSR; First man in space (Yuri Gagarin) – significant space milestone

04/19/1961: Lockheed UGM-27 Polaris A1 launched, USS *Robert E. Lee*, ETR

04/21/1961: MM MGM-31 Pershing 1 launched, LC-30A, CCAFS

04/25/1961: Mercury-Atlas 3 launched by GD Atlas LV-3B, LC-14, CCAFS; **FAILURE**, destroyed by range after guidance failure

Events in May (10 to 60 years ago)

05/07/2011: LM SBIRS-GEO 1 (first SBIRS) launched by ULA Atlas V-401, SLC-41, CCAFS

05/16/2011: STS-134 (*Endeavour*) launched, LC-39A, KSC; last flight of Endeavour, 6-person crew, ISS mission

05/25/2011: Lockheed Martin Press Release: NASA Selects OSIRIS-REx as next New Frontiers Mission

NO EVENTS IN MAY 2001

05/10/1991: Lockheed UGM-96 Trident I launched (two), USS *Mariano G. Vallejo*, ETR
 05/14/1991 RCA NOAA-12 launched by GD Atlas E, SLC-3W, VAFB
 05/23/1981: Intelsat V F-1 launched by GD Atlas SLV-3D Centaur-D1AR, LC-36B, CCAFS
 05/05/1971: DSP launched by MM Titan III(23)C, LC-40, CCAFS
 05/09/1971: Mariner 8 launched by GD Atlas SLV-3C Centaur D, LC-36A, CCAFS; **FAILURE** – gyroscope malfunction upper stage
 05/30/1971: Mariner 9 launched by GD Atlas SLV-3C Centaur D, LC-36B, CCAFS; first spacecraft to orbit Mars
 05/01/1961: Lockheed UGM-27 Polaris A2 launched, LC-29A, CCAFS
 05/01/1961: Lockheed UGM-27 Polaris A1 launched, USS *Abraham Lincoln*, ETR
 05/05/1961: Mercury-Redstone 3 launched, LC-5, CCAFS; First American in space (Alan Shepard – see the article in the second quarter MARS STAR)
 05/08/1961: Lockheed UGM-27 Polaris A2 launched, LC-29A, CCAFS
 05/13/1961: GD SM-65E Atlas launched, LC-11, CCAFS
 05/17/1961: Lockheed UGM-27 Polaris A1 launched (5 missiles), USS *Abraham Lincoln*, ETR
 05/19/1961: MM MGM-31 Pershing 1 launched, LC-30, CCAFS
 05/23/1961: MM HGM-25A Titan I launched, LC-20, CCAFS
 05/24/1961: GD SM-65D Atlas launched, LC-576B-2, VAFB
 05/25/1961: Lockheed UGM-27 Polaris A2 launched, USNS Observation Island, ETR
 05/26/1961: GD SM-65E Atlas launched, LC-13, CCAFS

Events in June (10 to 60 years ago)

06/10/2011: SAC-D launched by ULA Delta II 7320, SLC-2W, VAFB; last 7300 Delta II launch
 06/19/2001: ICO F2 launched by LM Atlas IIAS, SLC-36B, CCAFS
 06/05/1991: STS-40 (*Columbia*) launched, LC-39B, KSC; 7-person crew, SLS-1 Spacelab
 06/19/1981: Four Lockheed UGM-73 Poseidon C3 missiles launched, USS *Lewis and Clark*, ETR
 06/23/1981: RCA NOAA-7 launched, GD Atlas E/F Star-37A-ISS, SLC-3W, VAFB
 06/15/1971: Classified program launched by MM Titan III(23)D, SLC-43, VAFB; first flight of Titan IIID
 06/20/1971: MM LGM-25C Titan II launched, LC-395C, VAFB
 06/29/1971: RVTO-2A-3 launched by GD Atlas E/F, ABRES A-3, VAFB
 06/07/1961: GD SM-65E launched, OSTF-1, VAFB; **FAILURE**
 06/08/1961: Discoverer 24 launched, Thor DM-21 Lockheed Agena-B, LC-75-3-4; **FAILURE**

06/09/1961: MM MGM-31 Pershing 1 launched, LC-30, CCAFS
 06/12/1961: Lockheed UGM-27 Polaris A2 launched, LC-25A, CCAFS
 06/16/1961: Discoverer 25 launched, Thor DM-21 Lockheed Agena-B, LC-75-1-1
 06/23/1961: GD SM-65E Atlas launched, LC-11, CCAFS; **FAILURE**
 06/24/1961: MM HGM-25A Titan I launched, LC-19, CCAFS; **FAILURE**
 06/26/1961: Lockheed UGM-27 Polaris A2 launched, USNS Observation Island; **FAILURE**

Reference websites:

<https://nssdc.gsfc.nasa.gov/planetary/chronology.html#2014>
https://en.wikipedia.org/wiki/Timeline_of_spaceflight
<https://www.ulalaunch.com/missions>
<https://news.lockheedmartin.com/news-releases?year=2021>
<https://space.skyrocket.de>
<http://www.astronautix.com>

Next Edition

Check the next MARS STAR for the story of the, the Apollo 15 mission. The profile will blend the usual technical details of the mission with my personal remembrances of seeing the launch in 1971 and later meeting Astronaut Jim Irwin while I was in college. The History on the Road stories will be reinstated in a later MARS STAR.

Barb Sande, MARS STAR and MARS Facebook Page Historian. Contact me at barbsande@comcast.net or 303-887-8511 or find MARS Associates on Facebook.

Bridge Club

By Dave & Kathy Martz
martz20@comcast.net

MARS Bridge is back! June was our first month back with face-to-face, social bridge. What a joy it was to see some of the players again. If you're interested in playing bridge with our group, please give us a call.

We meet monthly to share the camaraderie and a good game of bridge! All MARS members and their guests are welcome. We play on the **3rd Friday of each month at the Buck Community Recreation Center (Littleton) from 10 AM to 2 PM.** You'll need to pack a lunch, as we stop midday to eat. The club provides the cards and all required items for the games. We also provide coffee, tea, and hot water. There is a small fee for the Buck Center, as well as a small fee to the club

(which helps with supplies and the year-end party in December).

We have couples, as well as singles, playing. If you're a single, invite a friend to be your partner. Your partner does not need to be a MARS member to play.

If you want to join us for bridge or have any questions, please contact any of the following Bridge Club Officers:

Presidents:

Dave & Kathy Martz, 303-683-9524

Vice-President:

Bill Kacena, 303-973-2685

The 2nd Quarter 2021 winners are as follows:

We were not playing in April and May due to a shutdown of the Buck Center because of COVID.

June 18 (3 tables)

1st - Bill & Mavis Kacena

2nd - Ed & Laurie Bock

3rd - Ernie & Cecile Berliner

4th - Dave & Kathy Martz

Car Club

By Roger Rieger

rrieger10731@gmail.com

303-912-6217

Carol Lovelace

cyberbear51@comcast.net

303-358-7459

Hello Car Clubbers! Summer's here, vaccines are available to put in arms, and we are off and rolling! Our first car club newsletter was pulled together by Carol and featured some very interesting articles submitted by fellow clubber Bob Maples and his track driving adventures, and Eric and Cindy Georges and their experiences building and running dragsters on the drag circuit, who knew we had such talent in the club!

Several club members got together at Living the Dream Brewery in May and kicked around ideas for club events for the coming year. Like all good ideas, they just need someone to take the lead and set up the event! Fellow club member Dave Bourcier has volunteered to put together a club drive/lunch event in August, planning for the 10th, for a spirited (or leisurely) drive to Evergreen Lake, Boettcher Mansion on Lookout Mountain, then onward to Golden for lunch. Also Carol has begun planning for a visit to the Rambler museum; keep an eye out for her emails!

Fellow club members have participated in a couple of the Cars and Coffee car shows held the first Saturday of

the month at Cornerstone Church (9941 Lone Tree Parkway, Lone Tree) in May and June. These are low key events with a large variety of cars participating and are a fun event and reason to shine up the ride and take her (or him) for a spin! The club plans to participate in these throughout the summer, skipping the 3rd of July, please come out and join us!



Back L-R: Bob Paulson, Roger Rieger, Dave Ernst, Dave Schwiesow, Terry Lillibridge.

Front: Karen Paulson, Carol Lovelace

Other events discussed at the kick off meeting are a visit to the Forney Museum of Transportation; a "behind the scenes" tour at Bandimere Speedway; a visit to High Plains Raceway. Now all we need is for someone to step forward and help organize!

MARS Club events: Our annual Club car show will be held in conjunction with the annual MARS picnic on Saturday, 8 September @ Clement Park. Also, for those car club members who are participating in the MARS Senior recognition luncheon (14 July @ Ken Caryl Manor House) bring your cars and we will park in the lower parking lot area.

Happy motoring and hope to see you soon at a club event! If you are interested in joining the club, please drop either Carol or myself an email, we'd love to have you!

Dinner Club

By Becky and Gary Englebright

englebright@me.com

303-941-3167 (Gary)

303-263-6457 (Becky), and

Anita Kannady

anitakannady@yahoo.com

303-794-9210

The dining club is back in the business -- going out to eat. In the last three months we have been to Outback,

Red Lobster and Zest with a really good turnout at each of the events. It was really good to see everyone again.

Becky has been scrambling to get restaurants booked for the rest of the year and it looks like she has finally accomplished that. See below for a by-month list of where we are going for the remainder of the year. You should have also gotten this list via email. Hopefully things will settle down soon so that we can resume normal operations (whatever normal is) so that we won't be pestering everyone with emails. If you're reading this and have not been getting update emails from us, it is probably because we don't have a current email address for you. If you would like to be added to our email list, you can call or email us with your email address. See our contact information above. Any email information sent to us will be kept in confidence.

We want to encourage anyone who is interested to join us for any of luncheons. Please send us an email so that you can be added to our mailing list.

Here is the schedule for the remainder of the year:

August 24th – Cinzzetti's Italian (Northglenn)
September 22nd – Imperial Chinese (Denver)
October 12th – Hickory House (Parker)
November 9th – Maggiano's Little Italy (Englewood)

Life's too short for boring food!!!!

Golf League

By Bo Rodriguez

The MARS Golf League had a much better start this year as compared to last year. Indications show the COVID-19 virus is now appearing in our rear view mirror at least in the Denver metro region. Also the weather has been kind to us as we have had only one cancellation so far. The golf course operation is back to normal this year with no limitations and water stations have been returned to their regular location on the course. Our remaining season from July through the month of October should present good weather so we may enjoy nine team events (4 team scramble, 2 team best ball, 4 team 2 best ball) and nine individual events (based on individual stroke play and Modified Stableford). On August 12th and 19th we will have our combined two week annual individual stroke championship tournament paying low net winners and awarding the medalist trophy to the low gross score player.

Our league has fifty members this season and we have secured twelve tee times for our league at Broken Tee Golf Course. We have also accommodated guest players upon request in our weekly schedule. If you and/or your spouse enjoy playing golf and would like to join our league, or experience play as a guest player, please feel

free to contact me at my email noted above or call me (303) 798-9157. I encourage you to log on to our MARS website: www.marsretirees.org and click on "Golf" to get a complete update on our league activates, membership and much more. You will see that our past weekly results, based on our high to low handicap index system, show women and men who have won prize money in varying flight categories as well as closest to the pin awards.



Hiking Club

By Sue Janssen

(susan.g.janssen@gmail.com)

No article this quarter since we did not have any hikes.

If you wish to join the MARS Hiking Club, contact Sue Janssen at susan.g.janssen@gmail.com who will add you to the club distribution list. Please provide your email address, home phone and cell phone for the roster. The schedule of hikes is posted on the MARS website (<https://www.marsretirees.org/>). Even if you have never gone snowshoeing or hiking you are welcome to join in the fun.

Happy trails!



Photography Club

By John Chapter

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303-986-8277

The Mars Photography Club does not have any scheduled meetings or activities, for June, July, and August 2021, because many club members travel during this period.

Our next meeting is scheduled for September 9, 2021. Before the COVID-19 pandemic we met at the Littleton Library and after March 12, 2020, we had virtual meetings online, using the popular Zoom.com (*computer program*).

Our club meetings were in person, at the Littleton Library prior to March 20, 2020. The Library will not host any in-person meetings for the rest of this year; therefore, we will continue using *Zoom.com* to present our programs virtually until further notice.

Please check the MARS Retirees Website for the latest Photo-Club meetings.

Thanks, and Regards, John Chapter and Jim Kummer
MARS Retirees Photo-Club

Colorado Springs Lockheed Martin Retiree Group News

By Doug Tomerlin
(dougincs@aol.com)

The Colorado Springs Lockheed Martin Retiree Group is an organization for retirees from any Lockheed Martin division. However, a large percent of our members live in the Colorado Springs area and have retired from divisions located in Colorado Springs. Retirees from heritage companies Philco, Philco-Ford, Ford Aerospace, and Loral are also welcome to join the group. There are no fees to belong to the group. Luncheons are usually held twice a year to allow retirees to stay in contact with each other. In addition, information about deaths, services, and other pertinent information is disseminated via email.

Our retiree group has still not sponsored any group activities since the last newsletter, due to the COVID-19 pandemic. We are hoping that we will be able to have a luncheon soon. If you would like more information about the group or the luncheons, please contact Doug Tomerlin at dougincs@aol.com.

We were all deeply saddened by the passing of fellow retirees Lu Fiandaco in April and Jay McKee in May.

We welcome Greg Barry to our retiree group.

Cape Canaveral News

By Dick Olson
(Olsons5145@aol.com)

Luncheons

April 2021 -- Well we had our first luncheon since last August and had a few brave souls turn up. Present were: Don Bollinger, Bill Masterson, Abe Smith, Ken Hawes, Ken Webb, Roger Wright, and Larry Gleason. It was fun to catch up and the main topics of discussion were "what have you been up to the past year?" and "how bad was your reaction to the COVID vaccination?" The answers were "mostly nothing" and "not bad to minor discomfort".

This is not an April Fool's joke and we plan on resuming the luncheons. Hope to see a few more folks in May. Have a happy Easter.

May 2021 -- A little better turnout this month, including a visitor from New Mexico and three first timers. Present were regulars: Roger Wright, Bill Rhode, Abe Smith, Matt Masterson, Bob Rodamer and Don Bollinger. Ben Dusenbery was here from New Mexico and will also be at Beef O'Brady's Friday about 5:00. Kim Winters joined us as she just moved back here from up north and is waiting to close on her house. Bill Reinhold and his wife Diane also made the scene. I believe Bill has recently retired. Mary Marr made her first luncheon and we hope to see all of them on a regular basis.

Don Bollinger mentioned that he ran into Dale Custer at the doctor's office and said Dale seemed to be doing pretty good. He also reported that Ray Caldwell is alive and kicking.

Want to wish all the mothers a Happy Mother's Day and to remind the rest of you that you best not forget that Sunday is Mothers Day. Stay healthy,

June 2021 -- Again a fairly light turnout. Present were: Bill Rhode, Jimmy Weddle, Roger Wright, Ken Webb, Wendell McDaniels, Don Bollinger, Abe Smith, Bob Matschner and Ray Hall and friend.

Jimmy Weddle said he spent 11 days in the hospital with COVID and still doesn't have his sense of smell or taste back yet. He is the only one of our group that I know of that had caught the virus and he said it kicked his butt.

Talked to Benny while he was here about planning another Titan reunion and thought maybe next year would work. Will keep you posted as things progress.

We won't meet again until after the Fourth of July so will wish everyone a happy 4th. Stay healthy,

July 2021 -- Had a little better turnout this month with a first time attendee, Norm White, and some we haven't seen for some time, Frank Indihar, Dave Kintigh and George Chambers and his wife Martha. Regulars include: Wendell McDaniels, Abe Smith, Bill Masterson, Roger Wright, Ken Webb, Don Bollinger, Bill Rhode and Bob Rodamer also made the scene.

People asked about Jerry Moskovitz who hasn't attended since Covid and Larry Gleason who has missed the last two months. Hope they are doing ok. Let me know if you have any news about them.

Roger said he didn't have any luck getting Lynn Johnston to attend -- Maybe next month.

Wish everyone a happy 4th of July and stay healthy.

Recent Obituaries

Martina Metcalf, 81, passed away 23 April. Marti was a secretary for Jim Chambers and others during her time with Martin.

Lockheed Martin (LM) News

OSIRIS-REx Begins Journey Home with Significant Asteroid Sample

Bennu sample's return to Earth in 2023 to mark NASA's first mission to collect asteroid material



OSIRIS-REx's last look at Bennu during its final flyby in April. Credit: NASA/Goddard/University of Arizona

DENVER, May 10, 2021 – Scientists are now one step closer to learning more about how our solar system formed – and, potentially, the origins of life. Today, the [OSIRIS-REx](#) spacecraft, which was designed, built and flown by Lockheed Martin [NYSE: LMT] for NASA, departed asteroid Bennu and is headed back to Earth with a pristine asteroid sample.

After a two-year, 1.4-billion-mile return cruise that includes two revolutions around the sun, OSIRIS-REx will catch up with Earth in its orbit in 2023 and jettison its sample return capsule. This protective capsule contains what is estimated to be well over the required 60 grams of regolith needed for scientific study, or roughly the size of a candy bar.

"It's both exciting and bittersweet," said Sandy Freund, mission operations program manager of the Lockheed Martin Mission Support Area, where OSIRIS-REx is flown. "I can't wait to see what we learn from the sample when it returns to Earth. Yet, at the same time, we've now said goodbye to this asteroid that we've gotten to know so well over the past couple of years."

The Science Behind the Mission

Bennu is of keen interest for scientists because they believe it to be a well-preserved remnant from the beginnings of our solar system more than 4.5 billion years ago. It could contain clues about whether asteroids helped deliver ingredients for life to Earth and could also provide a glimpse into specific natural resources asteroids possess.

Once Bennu's sample lands in the Utah Test and Training Range on Sept. 24, 2023, it will be curated at NASA's Johnson Space Flight Center in Houston and shared with teams around the globe. With upcoming scientists and engineers in mind, NASA will save 75 percent of the sample for future generations to study.

The Long Journey Home

Today's departure maneuver was the mission's longest engine burn since arrival at Bennu in 2018. OSIRIS-REx's main engines fired for seven minutes, changing its velocity by 0.16 miles per second – about the cruising speed of a commercial airliner – and sending it on a trajectory to meet up with Earth in two and a half years.

OSIRIS-REx is the first NASA mission to collect material from an asteroid. It also represents the largest sample collected by a NASA mission since Apollo. This is NASA's third robotic sample return mission, and Lockheed Martin has built and operated all three of those spacecraft.

NASA's [Goddard Space Flight Center](#) in Greenbelt, Maryland, provides overall mission management, systems engineering, and the safety and mission assurance for OSIRIS-REx. Dante Lauretta of the [University of Arizona](#), Tucson, is the principal investigator. The University of Arizona leads the science team and the mission's science observation planning and data processing. [Lockheed Martin Space](#) in Littleton, Colorado, built the spacecraft and provides flight operations. Goddard and KinetX Aerospace are responsible for navigating the OSIRIS-REx spacecraft. OSIRIS-REx is the third mission in NASA's New Frontiers Program, managed by NASA's [Marshall Space Flight Center](#).

Lockheed Martin, General Motors Team-up to Develop Next-Generation Lunar Rover for NASA Artemis Astronauts to Explore the Moon

DENVER, May 26, 2021 /[PRNewswire](#)/ -- Lockheed Martin [NYSE: LMT] and General Motors Co. [NYSE: GM] are teaming up to develop the next generation of lunar vehicles to transport astronauts on the surface of the Moon, fundamentally evolving and expanding humanity's deep-space exploration footprint.

NASA's [Artemis](#) program is sending humans back to the Moon where they will explore and conduct scientific experiments using a variety of rovers. NASA [sought industry approaches](#) to develop a Lunar Terrain Vehicle (LTV) that will enable astronauts to explore the lunar surface farther than ever before. The LTV is the first of many types of surface mobility vehicles needed for NASA's Artemis program.

To support NASA's mission, the two industry leaders will develop a unique vehicle with innovative capabilities, drawing on their unparalleled engineering, performance, technology and reliability legacies. The result may allow astronauts to explore the lunar surface in unprecedented

fashion and support discovery in places where humans have never gone before.

Lockheed Martin will lead the team by leveraging its more than 50-year-history of working with NASA on deep-space human and robotic spacecraft, such as NASA's [Orion](#) exploration-class spaceship for Artemis and numerous Mars and planetary spacecraft.

"This alliance brings together powerhouse innovation from both companies to make a transformative class of vehicles," said Rick Ambrose, executive vice president, Lockheed Martin Space. "Surface mobility is critical to enable and sustain long-term exploration of the lunar surface. These next-generation rovers will dramatically extend the range of astronauts as they perform [high-priority science](#) investigation on the Moon that will ultimately impact humanity's understanding of our place in the solar system."

GM is a leader in [battery-electric technologies](#) and propulsion systems that are central to its multi-brand, multi-segment electric vehicle strategy, positioning the company for an all-electric future. Additionally, GM will use autonomous technology to facilitate safer and more efficient operations on the Moon.

"General Motors made history by applying advanced technologies and engineering to support the Lunar Rover Vehicle that the Apollo 15 astronauts drove on the Moon," said Alan Wexler, senior vice president of Innovation and Growth at General Motors. "Working together with Lockheed Martin and their deep-space exploration expertise, we plan to support American astronauts on the Moon once again."

GM has a proven [history](#) of supporting NASA and working within the space industry. The company manufactured, tested and integrated the inertial guidance and navigation systems for the entire Apollo Moon program, including Apollo 11 and the first human landing in 1969. GM also helped develop the electric Apollo Lunar Roving Vehicle (LRV), including the chassis and wheels for the LRV that was used on Apollo's 15-17 missions.

Unlike the Apollo rovers that only traveled 4.7 miles (7.6 kilometers) from the landing site, the next-generation lunar vehicles are being designed to traverse significantly farther distances to support the first excursions of the Moon's south pole, where it is cold and dark with more rugged terrain.

Autonomous, self-driving systems will allow the rovers to prepare for human landings, provide commercial payload services, and enhance the range and utility of scientific payloads and experiments.

Lockheed Martin brings unparalleled experience and capabilities in deep-space exploration. It has built spacecraft and systems that have gone to every planet, been on [every NASA mission to Mars](#) including building 11 of the agency's Mars spacecraft, and played major

roles on the space shuttle program and International Space Station power systems.

Announcement press conference replay:
<https://youtu.be/TpXz6QAAJWE>

Rover animation:
<https://www.youtube.com/watch?v=5869I2cKLZw>

Feature story: <https://www.lockheedmartin.com/en-us/news/features/2021/lunar-terrain-vehicle.html>

Lockheed Martin to Help NASA Uncover Mysteries of Venus with VERITAS and DAVINCI+ Spacecraft

Lockheed Martin has a major role in NASA's long-anticipated return to Venus

DENVER, June 2, 2021 /PRNewswire/ -- To learn more about how terrestrial planets evolve over time, NASA selected the VERITAS and DAVINCI+ missions for its Discovery Program, both bound for Venus. Lockheed Martin will design, build and operate both spacecraft. The missions will launch in the 2028-2030 timeframe, and will combine to study Venus' dense atmosphere, topography and geologic processes in great depth.

Both missions will aim to discover how Venus – which may have been the first potentially habitable planet in our solar system – became inhospitable to life. They represent NASA's return to Earth's sister planet after more than three decades.

The operations and science for DAVINCI+ – which stands for Deep Atmosphere Venus Investigation of Noble Gases, Chemistry and Imaging Plus – will be managed by NASA's Goddard Space Flight Center in Greenbelt, Maryland.

VERITAS – which stands for Venus Emissivity, Radio Science, InSAR, Topography & Spectroscopy – will have its science and operations managed by NASA's Jet Propulsion Laboratory in Southern California.

Why Does Venus Matter?

Though scientists believe it was once similar to our home planet, Venus evolved to be much different – and far less habitable – than Earth.

As Earth's own climate and geology evolve, interest in returning to Venus has surged because the planet currently suffers from a runaway greenhouse gas effect.

Over millennia, water that may have once existed on Venus' surface evaporated and carbon dioxide built up in the atmosphere – leading to a present-day surface temperature that's hot enough to melt lead.

Previous missions to Venus have even provided tantalizing clues that the planet may have once harbored a liquid ocean.

DAVINCI+ and VERITAS will build on those findings, helping scientists better understand the existence of

past life on Venus and how its atmosphere and geology may have influenced its ultimate outcome.

Science from these missions could provide clues about Earth's own future and will also help inform future missions to the planet.

Studying Venus' Geology with VERITAS

As an orbiter that draws on heritage from the Lockheed Martin-built [MAVEN](#) spacecraft at Mars, VERITAS will give scientists the most detailed maps ever produced of Venus' obscured landscape.

When VERITAS arrives at Venus, the orbiter will use a special technique called aerobraking to carefully insert itself into an optimal science position in the planet's orbit.

As the spacecraft circles Venus in four cycles near the planet's poles, two extremely sensitive imagers will capture things like volcanic activity, tectonics and outgassing of any life-related compounds like water or carbon.

Measuring Venus' Atmosphere with DAVINCI+

Part orbiter and part probe, the DAVINCI+ spacecraft will provide a look into Venus' atmosphere in unprecedented detail.

When it arrives at Venus, the DAVINCI+ spacecraft will jettison a probe to the planet's surface. As it descends, three instruments will take the first-ever live measurements from inside Venus's atmosphere – assessing gases, material composition, temperature and pressure.

A camera on board will also snap the most detailed images ever taken of Venus' hidden surface, which is obscured by thick, noxious clouds.

Legacy of Planetary Exploration

VERITAS and DAVINCI+ are the eighth and ninth NASA

Discovery Program missions Lockheed Martin has been part of. Previously, the company has:

- Developed the [Lunar Prospector spacecraft](#)
- Designed and built the aeroshell entry system for [Mars Pathfinder](#)
- Designed, built and operated the spacecraft for the [Stardust missions](#)
- Designed, built and operated the Genesis spacecraft
- Designed, built and operated the two [Gravity Recovery and Interior Laboratory \(GRAIL\) spacecraft](#)
- Designed, built and operated the [InSight Mars lander](#)
- Designed, built and will operate the [Lucy mission](#) to Jupiter's Trojan asteroids, set to launch in October 2021

NASA's Discovery Program-class missions are capped at a specific, relatively low cost. They are managed for NASA's Planetary Science Division by the Planetary Missions Program Office at Marshall Space Flight Center in Huntsville, Alabama. The missions are also designed

and led by a principal investigator, who assembles a team of scientists and engineers to address key science questions about the solar system.

Over 50 years, Lockheed Martin has helped NASA explore every [planet of our solar system](#), and continues to develop new technologies for future space missions.

The company also supported NASA on Magellan, the agency's prior mission to Venus 30 years ago. Lockheed Martin built that spacecraft, which produced the first ever maps of Venus' surface from orbit.

Now, the team builds on that legacy of discovery with DAVINCI+ and VERITAS.

United Launch Alliance News

NASA adds United Launch Alliance Vulcan Centaur Rocket to Launch Services Program Catalog

ULA's next generation rocket to compete for future NASA launches

Centennial, Colo., April 15, 2021 – NASA's Launch Services Program (LSP) has added United Launch Alliance's next generation rocket, the Vulcan Centaur, to the NASA Launch Services II (NLS) indefinite delivery/indefinite quantity contract in accordance with the on-ramp provision of NLS II.

The NLS II on-ramp provision provides an opportunity for new and existing NLS II launch services providers to introduce new launch vehicles not currently on the NLS II contract. NLS II contractors must have the ability to successfully launch and deliver a payload to orbit using a domestic launch service capable of placing, at minimum, a 250 kg (551 lb.) payload into a 200 km (124 mile) circular orbit at an inclination of 28.5 degrees.

ULA and its heritage rockets have partnered with NASA to explore the universe and have launched spacecraft to every planet in the solar system including all 20 U.S. led missions to Mars. In addition to missions that explore the universe, ULA and its heritage rockets have partnered with NASA to explore planet Earth, have launched every NOAA Geostationary Operational Environmental Satellite (GOES) satellite and all U.S. weather satellites currently in operation. Overall, ULA has launched 35 missions for NASA LSP with 100% mission success.

Vulcan Centaur is ULA's next-generation, innovative new launch vehicle that provides higher performance, greater affordability and multi-manifesting flexibility while continuing to deliver unmatched reliability. In 2020, ULA's Vulcan Centaur was competitively selected by the

U.S. Space Force as the best value launch provider for 60 percent of the launches occurring through 2027. Vulcan Centaur is on track for a first launch later this year.

With more than a century of combined heritage, ULA is the nation's most experienced and reliable launch service provider. ULA has successfully delivered more than 140 missions to orbit that aid meteorologists in tracking severe weather, unlock the mysteries of our solar system, provide critical capabilities for troops in the field, deliver cutting-edge commercial services and enable GPS navigation.

Commercial Crew

John Glenn became the first U.S. astronaut to orbit the Earth after being launched on a heritage Atlas LV-3B rocket from Cape Canaveral, Florida, in 1962. We are proud to continue this heritage as we prepare to launch the Atlas V Starliner.

A ULA Atlas V rocket will send astronauts to the International Space Station (ISS) aboard The Boeing Company's CST-100 Starliner capsule. The Starliner will launch on the Atlas V from Space Launch Complex-41 at Cape Canaveral Space Force Station, on Florida's Space Coast.

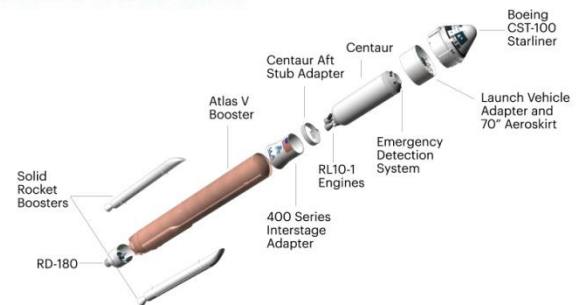
Three NASA astronauts, Mike Fincke and Nicole Mann and Barry "Butch" Wilmore, will launch aboard the Atlas V Starliner on the Crew Flight Test (CFT) mission. Astronauts Sunita Williams and Josh Cassada will launch on the first mission to the International Space Station.

Safety is a critical part of the ULA decision-making process, and we fully understand the responsibility and honor of launching American astronauts. ULA has performed a tremendous amount of work in conjunction with Boeing and NASA to ensure our designs provide the highest level of safety to the crew.

Configuration

The Atlas V Starliner builds on ULA's solid history of success and incorporates new technologies designed for crew safety.

ATLAS V STARLINER



Dual Engine Centaur: For CST-100 Starliner missions, the Centaur upper stage will fly with two RL10A-4-2 engines, offering more thrust to accommodate the Starliner. It also helps shape the ascent trajectory to the Space Station.

Launch Vehicle Adapter (LVA) and Aeroskirt: The launch vehicle adapter (LVA) provides the structural attachment of the Starliner capsule to the Atlas V rocket. The LVA uses a truss structure and metallic ring to attach the spacecraft to the Centaur upper stage. ULA also designed a 70-inch-long aeroskirt to extend the Starliner aerodynamic surface, which enhances the aerodynamic characteristics, stability, and loads of the Atlas V for the unique crewed configuration.

Emergency Detection System (EDS): This system monitors various launch vehicle parameters to determine the health of the rocket, and provides a capability to take action by signaling an abort command so the Starliner can escape if necessary.



Join Us for the Annual Rite of Summer

MARS ANNUAL PICNIC



WE'RE BACK FOR THE ANNUAL PICNIC! The Officers and Directors of MARS Associates invite you, your spouse or companion, and your friends to celebrate the end of summer with an old-fashioned barbecue picnic complete with BBQ ribs, pork, and chicken plus all the trimmings, provided by Bennett's Bar-B-Que. There will also be water, wine and beer, and door prizes. The event will be **Wednesday, September 8, 2021**, and will be held at **Clement Park**. The event will be in Pavilions A, B, and C located on the east side of the park (map of park is on the reverse side). The event will be held rain or shine. **The BBQ line will open at 12:00 noon.**

The cost of the picnic is \$25.00 for members and spouse/companion and \$35.00 for non-MARS guests. **There are two payment options.** If you wish to pay electronically, **please use the STRIPE link (CTRL+click) below:**

STRIPE: <https://form.jotform.com/211835727112047>

OR, if you wish to pay by check, please complete the form at the bottom of this sheet, detach it along the dotted line, and mail it with your check (**made payable to MARS Associates**) to the address on the form.

Reservations and cancellations must be received by August 30, 2021. If you must cancel, please notify Linda Duby at 303-249-1665 or lindaduby@comcast.net; Carl Kaminski at 303-726-1546 or carlco@centurylink.net; or Charlie Haupt at 303-725-7595 or rugrefree@q.com. Please notify one of these persons **by August 31 to receive a refund.** MARS Associates must commit to an exact number of attendees and we must pay for that number as a minimum. Admission is by reservation only. Pick up name tags and drawing tickets as you enter the picnic area. The name tags will be available at 11:00 a.m.

----- Reservation Form (detach here) -----

2021 Annual Picnic Reservation Form – September 8, 2021. Please print clearly.

Mail to: MARS Associates, PO Box 1128, Littleton, CO 80160-1128

Member _____ Spouse/Companion _____

Non-MARS Guests _____

Member Phone No. _____ E-Mail address _____

Member/Spouse or Companion @ \$25.00/person = \$ _____

Non-MARS Guests @ \$35.00/person = \$ _____

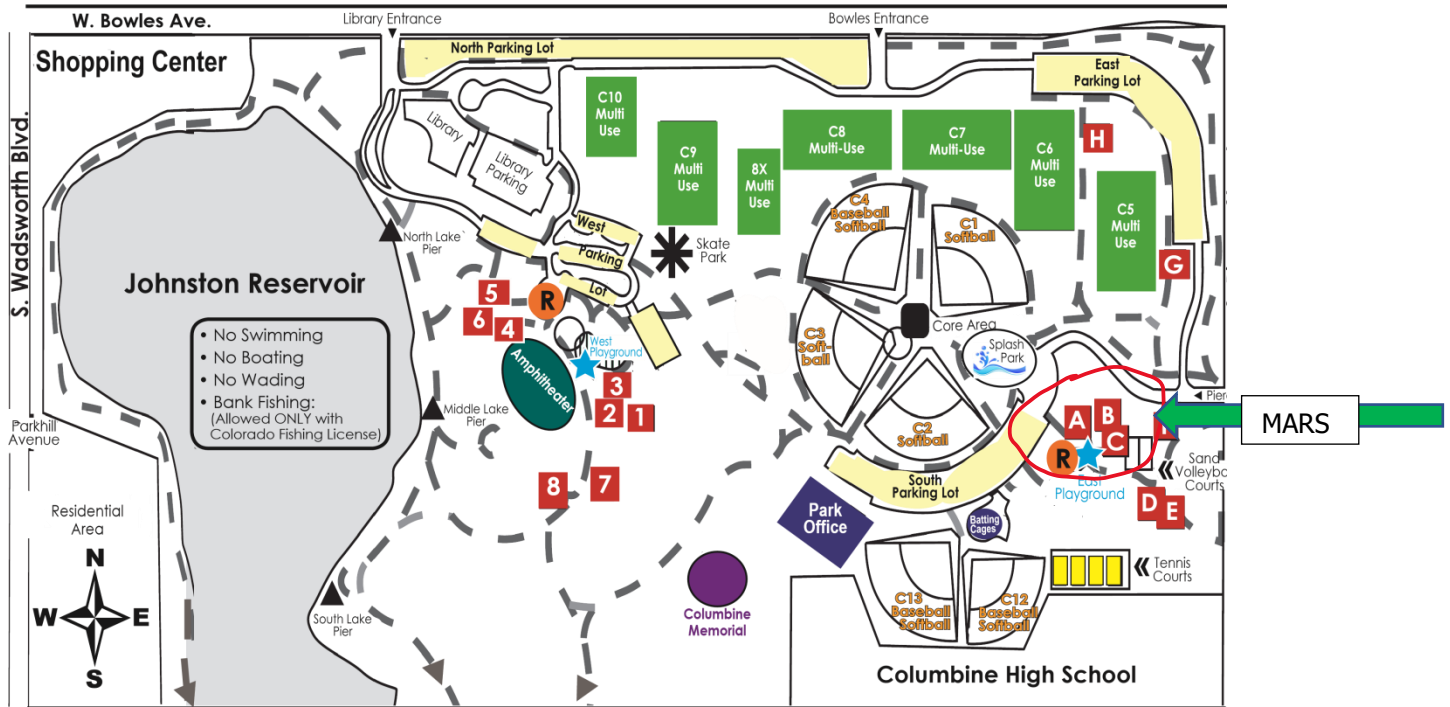
Total enclosed \$ _____ Check Number _____

Special dietary needs? Contact Linda Duby at 303-249-1665 or lindaduby@comcast.net with the details.

Robert F. Clement Park

7306 W. Bowles Avenue • Littleton, CO • 80123

Foothills
Park & Recreation Dis



The picnic will be held in Pavilions A, B and C.

Dinner on Tuesday, August 24th, 2021

Join your fellow MARS Associates for a wonderful early dinner at



Cinzzetti's

281 W. 104th Ave., Northglenn, CO 80204
(see map on back)
303-451-7300



Dinner will be served at **5:30 pm.**
(Doors open at **5:00 pm**)

Featuring a delicious Italian buffet including salads, entrées, desserts and non-alcoholic beverages.
Cash bar will be available. (Tax and gratuity included.)

Seating is LIMITED to 60
\$24/person

If we have reached the seating limit prior to receiving your reservation, we will contact you about putting you on a waiting list.

Please complete the form shown below and mail it, along with your check, payable to **MARS Associates Dinner Club** by **August 14th, 2021** to



Becky and Gary Englebright
7855 S. Vance Ct.
Littleton, CO 80128
303-941-3167 or 303-263-6457
englebright@me.com



If you need to cancel, please let us know no later than August 16th to receive a refund.

Dinner at Cinzzetti's on Tuesday, August 24th, 2021

Name(s): _____ Number of Attendees: _____

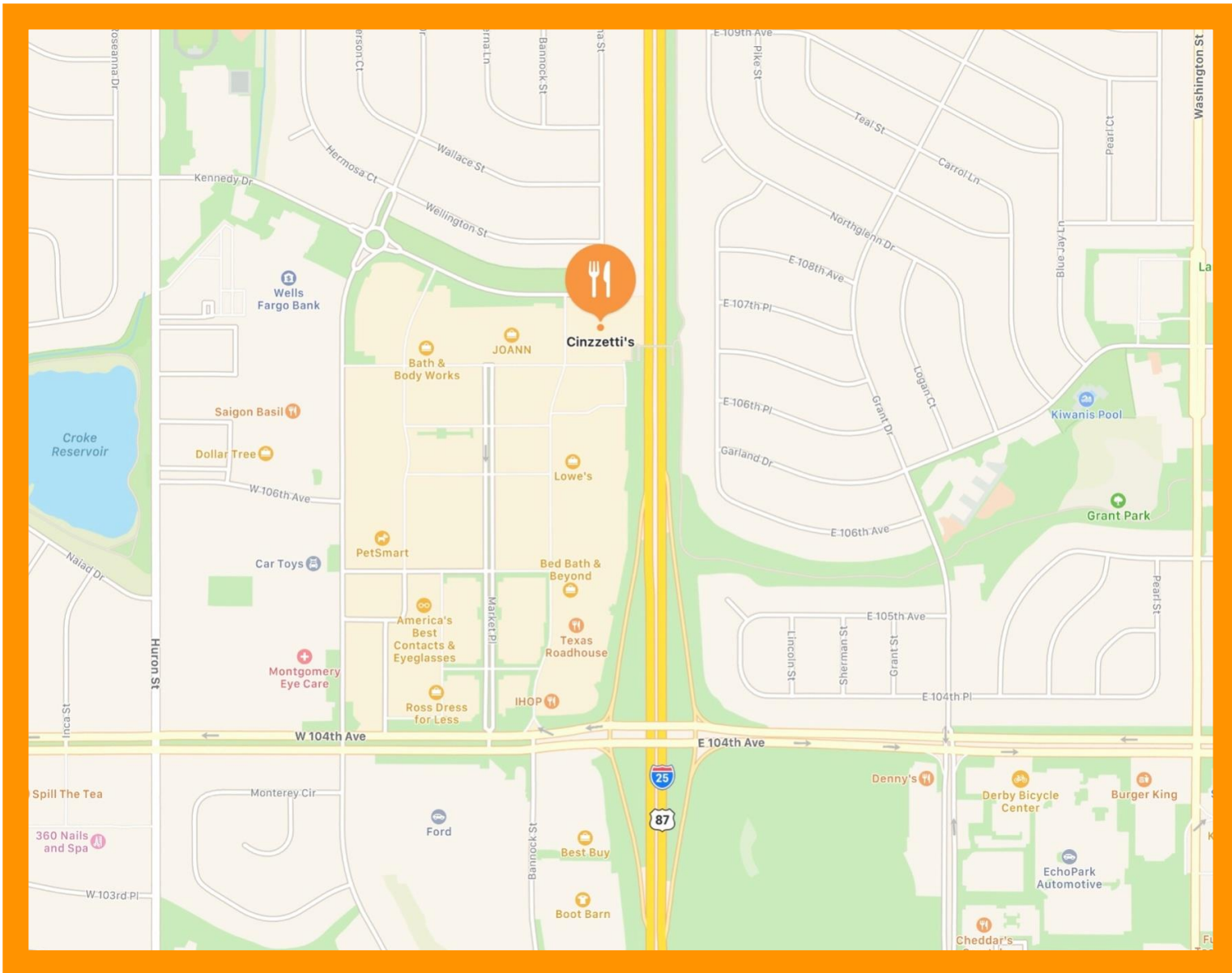
Address: _____ Amount of Check: \$ _____

City/State/Zip: _____ Check Number: _____

Phone Number: _____ Date: _____

Email: _____

Map to Cinzzetti's



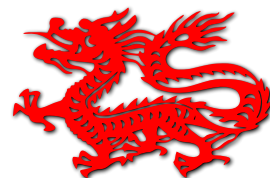
281 W. 104th Ave., Northglenn, CO 80204
303-451-7300

Lunch on Wednesday, September 22nd, 2021

Join your fellow MARS Associates for a wonderful lunch at



Imperial Chinese



431 S. Broadway, Denver, CO 80209
(see map on back)
303-698-2800

Lunch will be served at Noon.

Featuring a delicious family style lunch of wonderful Chinese delicacies including a gluten-free option, ice cream and hot tea. Cash bar for all other beverages will be available. (Tax and gratuity included.)

**Seating is LIMITED to 50
\$31/person**

If we have reached the seating limit prior to receiving your reservation, we will contact you about putting you on a waiting list.

Please complete the form shown below and mail it, along with your check, payable to **MARS Associates Dinner Club** by **September 9th, 2021** to

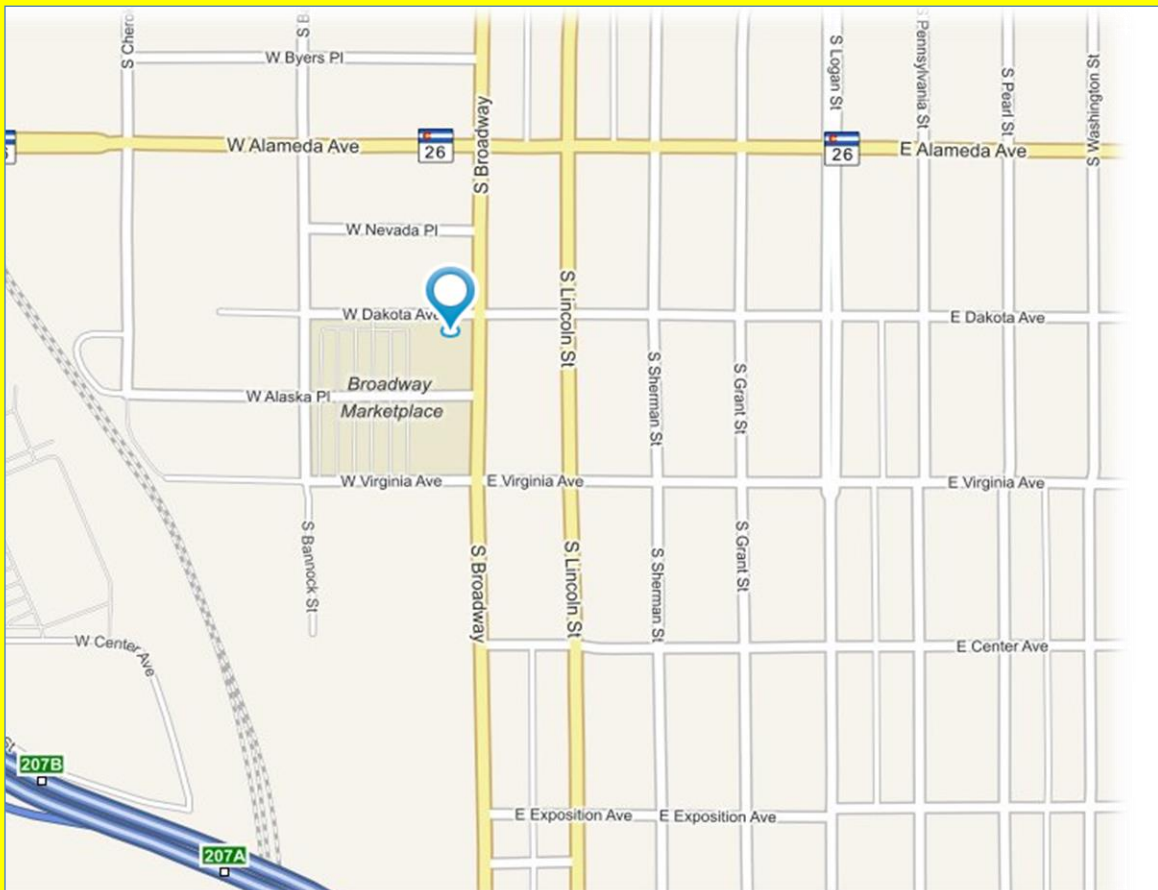
	Becky and Gary Englebright 7855 S. Vance Ct. Littleton, CO 80128 303-941-3167 or 303-263-6457 englebright@me.com	
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If you need to cancel, please let us know no later than September 14th to receive a refund.

Lunch at Imperial Chinese on Wednesday, September 22nd, 2021

Name(s): _____ Number of Attendees: _____
Address: _____ Amount of Check: \$ _____
City/State/Zip: _____ Check Number: _____
Phone Number: _____ Date: _____
Email: _____

Map to Imperial Chinese



431 S. Broadway, Denver, CO 80209

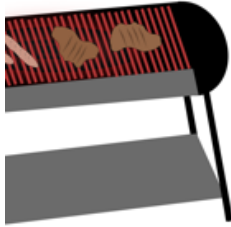
303-698-2800

Imperial is located at the northwest corner of W. Dakota Ave. and S. Broadway

Lunch on Tuesday, October 12th, 2021

Join your fellow MARS Associates for a wonderful lunch at

Hickory House BBQ



10335 S. Parker Rd., Parker, CO 80134

(see map on back)

303-805-9742

Lunch will be served at Noon.



Featuring a customized Family Style menu of BBQ ribs, chicken, beef brisket, pulled pork, sides, desserts and non-alcoholic beverages. Cash bar will be available. (Tax and gratuity included.)

Seating is LIMITED to 60

\$35/person

If we have reached the seating limit prior to receiving your reservation, we will contact you about putting you on a waiting list.

Please complete the form shown below and mail it, along with your check, payable to **MARS Associates Dinner Club** by **September 22th, 2021** to

Becky and Gary Englebright
7855 S. Vance Ct.
Littleton, CO 80128
303-941-3167 or 303-263-6457
englebright@me.com

If you need to send in your reservation after September 24th or if you need to cancel, please let Charlie or Glenda Haupt know no later than October 4th.

Their contact information is:

6600 S. Steele St., Centennial, CO 80121

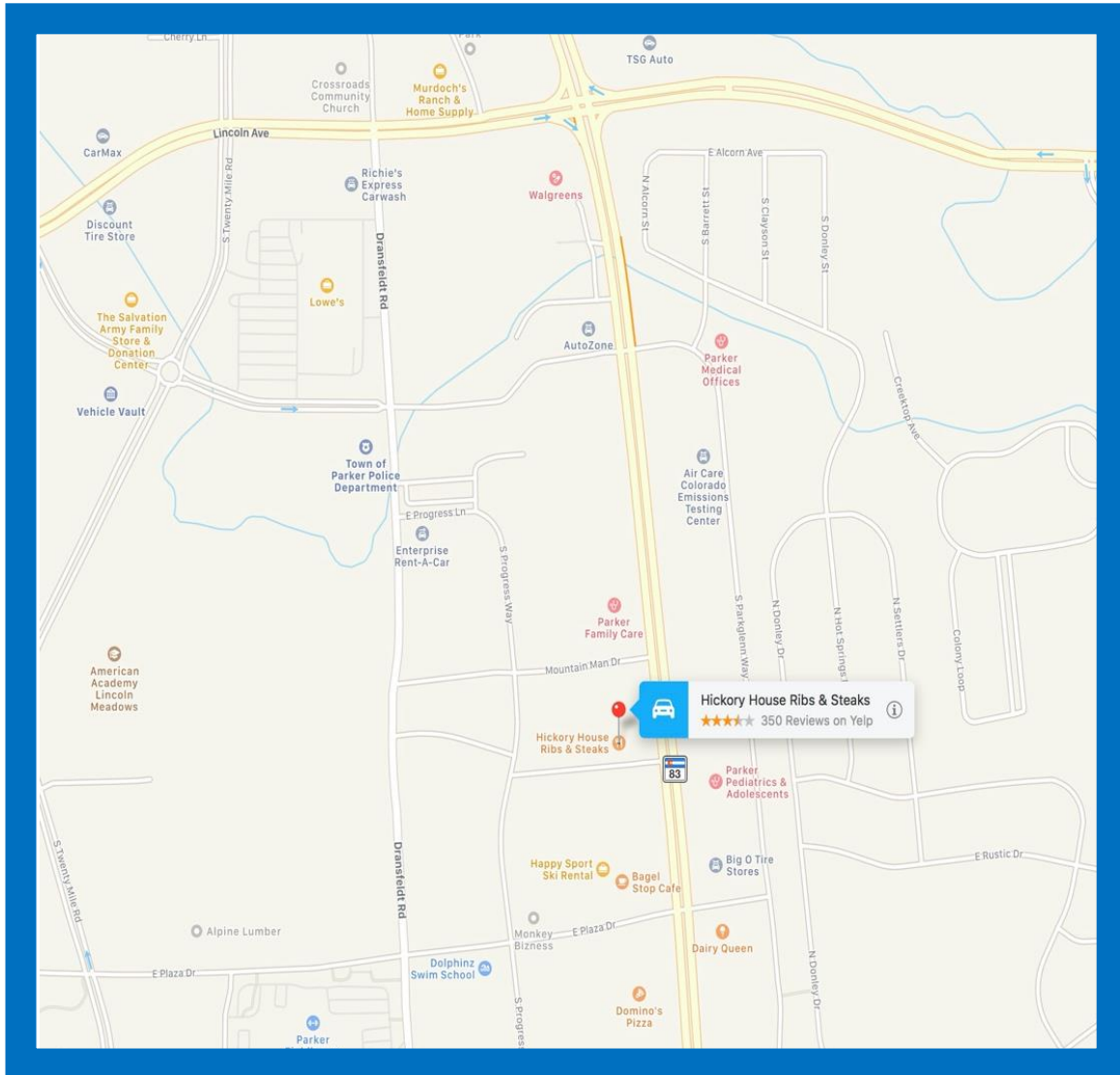
303-725-7595

rugreferee@q.com

Lunch at Hickory House BBQ on Tuesday, October 12th, 2021

Name(s): _____ Number of Attendees: _____
Address: _____ Amount of Check: \$ _____
City/State/Zip: _____ Check Number: _____
Phone Number: _____ Date: _____
Email: _____

Map to Hickory House BBQ

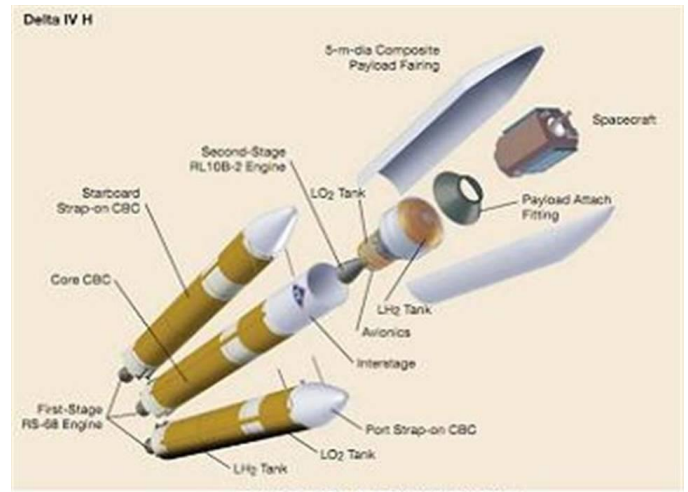


10335 S. Parker Rd., Parker, CO 80134
303-805-9742

Delta 4 Heavy

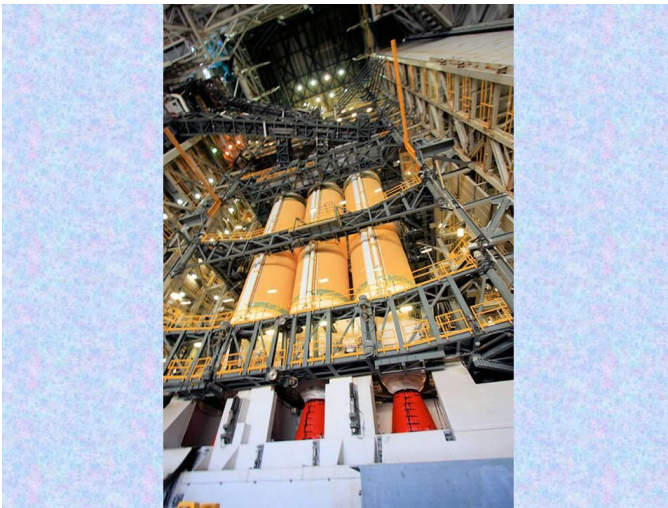
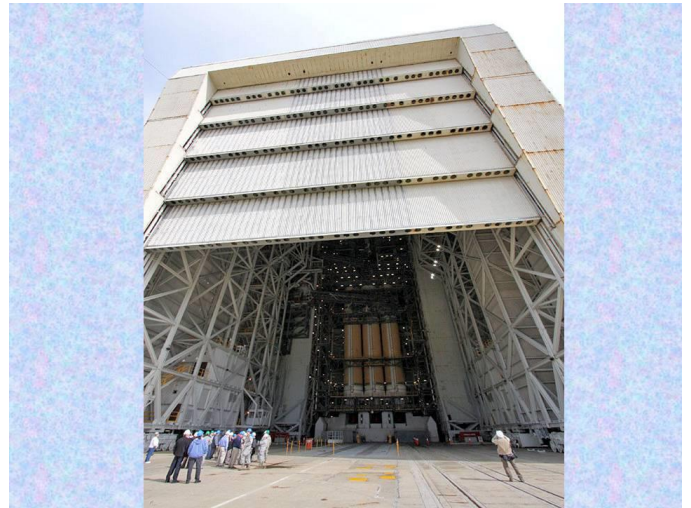
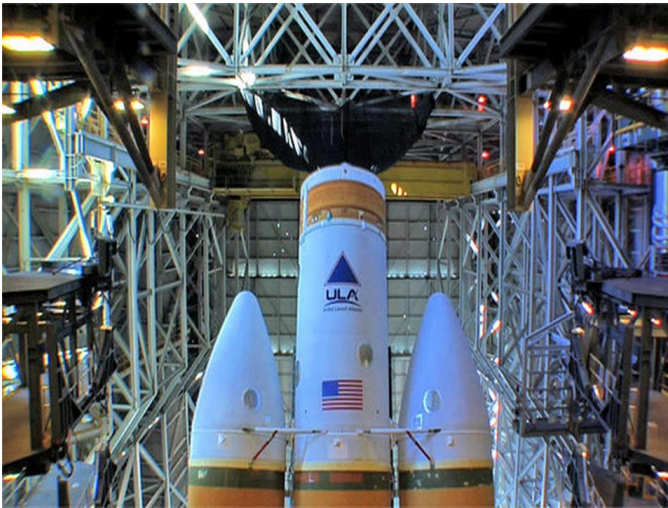
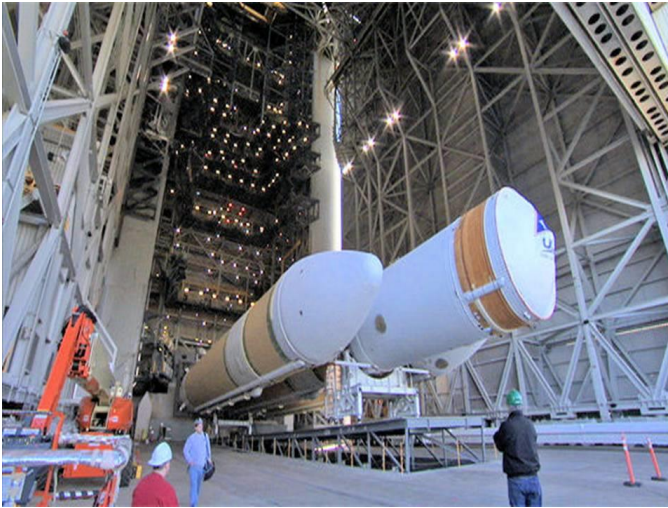
VAFB Arrival to Launch

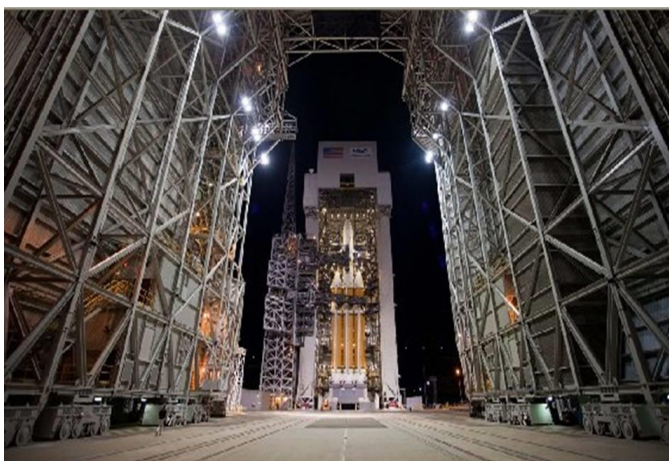
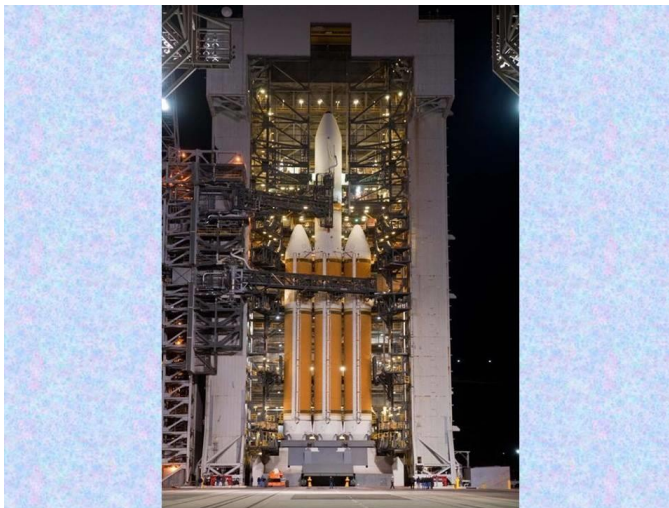
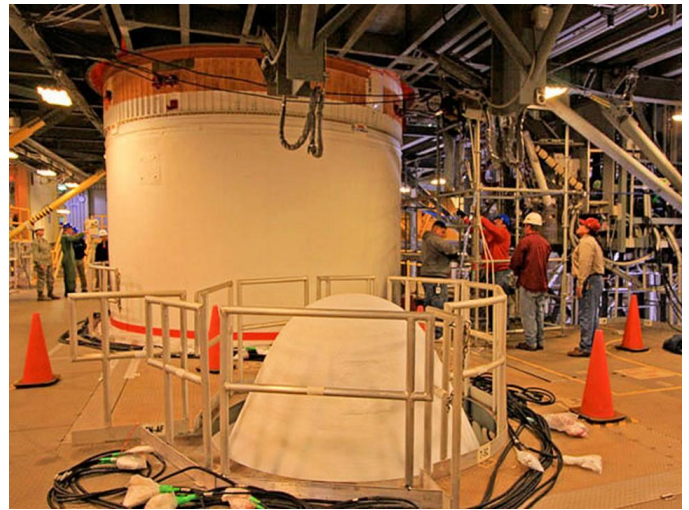
Provided by Monte Kopke





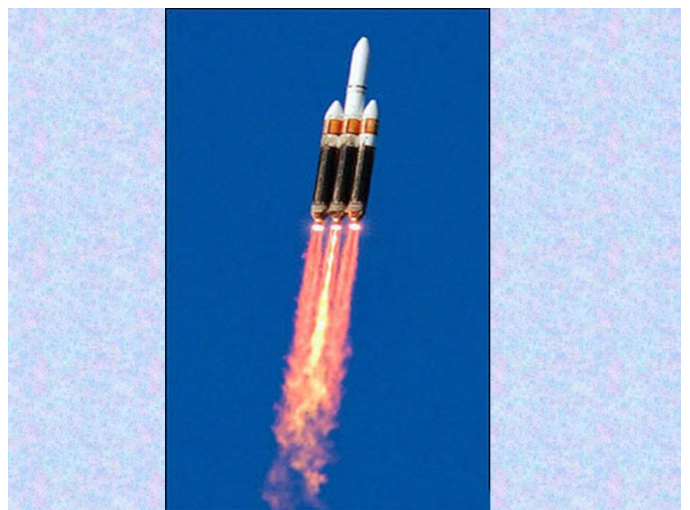
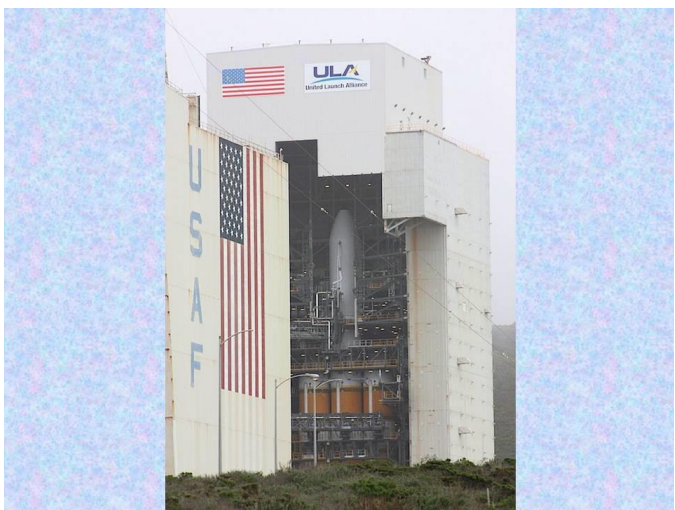
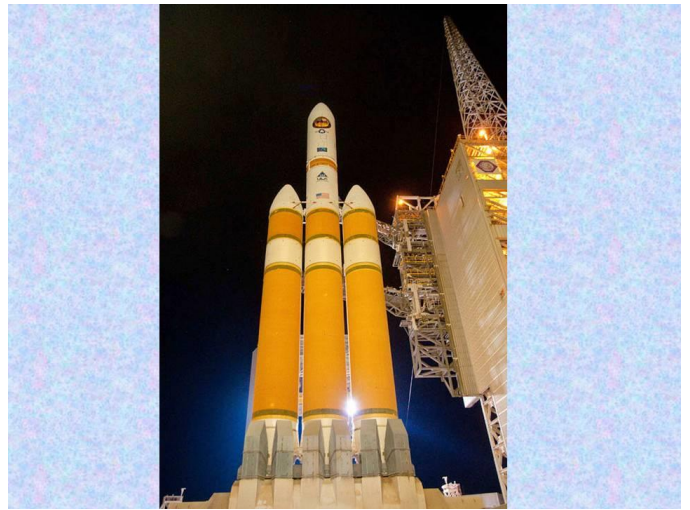


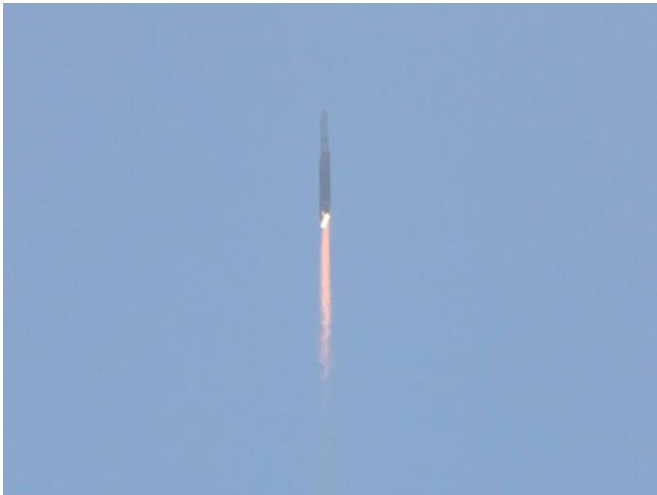




The first West Coast Delta IV Heavy sits poised on its launch pad with a National Reconnaissance Office payload at Space Launch Complex-6.







If you currently receive a printed copy you will continue to receive a printed copy. If you wish to receive hard (printed) copies in the future, contact Carl Kaminski at 303-726-1546 or via email at carlcolo@centurylink.net.

Schedule Addendum (See last page)

1. BOD meets as required
2. Officers/Directors meet 1st Wednesday of every month on Zoom at 09:30 am.
3. Bridge Club meets 3rd Friday of every month at 10:00 am at Buck Recreation Center.
4. Car Club meets as noted on their website and periodic newsletter.
5. Dinner Club (All events are lunch unless otherwise noted): Check website for details
6. Golf club meets every Thursday from April through Oct of each year.
7. Hiking Club: Outings on 3rd Wednesday of the month. Check website for Point of Contact for each hike.
8. Photo Club meets 2nd Thursday every month (except Jun, Jul & Aug) at 1:00 pm on Zoom
9. Web Committee normally meets on last Tuesday of month, prior to BOD/Officer mtg, at a designated restaurant or by email.
10. **2021** MARS Day at the Rockies - Aug 18
11. **2021** Annual Picnic - Sept 8 at Clement Park
12. **2021** Holiday Celebration - Dec 1 at Wellshire Inn
13. **2022** Annual Meeting - TBD Date and Location
14. **2022** Senior Recognition Luncheon -

Please review dates and times and notify Ken Marts (martshouse2@aol.com) if you have any changes or additions.



ASSOCIATES

P.O. Box
1128

ADDRESS

SERVICE

PRESORTED STANDARD
US POSTAGE
PAID
LITTLETON, CO
PERMIT NO. 245



DATE: Aug 2021

EVENT/MONTH						2022						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Officers/Directors	4	1	6	3	11/30	5	2	2	6	4	1	
Bridge Club		17	15	19	17	21	18	18	15	20	17	
Car Club		8										
Dinner Club	24	22	12	9	-	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Golf Club	Thur	Thur	Thur	-	-	-	-	-	-	-		-
Hiking Club	18	15	20	17	15	19	16	16	18	20	15	
Photo Club	-	9	14	11	9	13	10	10	12	14		
Web Committee	31	28	26	29	28	25	22	29	26	31	28	26
MARS Events												
Happy Hour		29										
CO Rockies Game	18											
Annual Picnic		8										
Holiday Celebration					1							
Annual Meeting								TBD				
Senior Recognition Luncheon												TBD
MARS STAR Schedule												
Items due for MARS STAR												
STAR Flyers Due to Comms			4			3			4			4
STAR Input to Editor			5			4			5			5
STAR Repro. Deadline			18			17			18			18
STAR Mailing			27			26			27			27