



# The Prairie Astronomer

January, 2012

Volume 53, Issue #1

The Official Newsletter of the Prairie Astronomy Club

## January Program

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## Featured Photo

## How to Use a Telescope

This is our annual program to help the people who have new scopes and need basic help to learn to use them. There will be a very short presentation and then we'll have our guests talk to members of the club to answer questions one on one about their scopes. We'll need as many club members as we can there to help out with the event. It would also be good to bring tools to help collimate or adjust our guest's telescopes with.

The Mercury space capsule undergoes testing in the Full Scale Wind Tunnel at Langley Research Center in Jan., 1959.

This image was taken on Jan. 22, 1959.

*Image Credit: NASA/Taub*



## The Mathematics of Iridium Flare Prediction - Ben Rush

Last month I described the very basics behind what are known as “orbital elements”, or properties of satellite orbits; this month I’m going to describe how to find and read these properties for the Iridium Satellite Constellation. Next month we’re going to break apart a couple of the more complicated numbers and see what they mean under the hood.

First thing, point your browser to this address: <http://celestrak.com/NORAD/elements/iridium.txt>. Here you will see a rather cryptic (unless, or even if, you know how to read it) listing of numbers which, one can assume at first glance, belong to each of the Iridium Satellites. Let’s take a look at the numbers for the very first satellite described on this page, Iridium 8:

```
IRIDIUM 8 [+]  
1 24792U 97020A 12015.48515268 -.00000405 00000-0 -15179-3 0 7434  
2 24792 86.3922 66.1590 0002367 90.7305 269.4204 14.34215198769440
```

This table is known as a two-line element set, or TLE for short. Software applications – or you if you’re half cylon – load and parse this table to achieve a precise understanding of a satellite’s position at any point in time. So if you wish to ask yourself, “where is this satellite?” it’s best if you then ask yourself, “where is its TLE?” But how does one read it?

In the interest of simplicity, let’s break it down column-by-row and see exactly what these properties mean. The first line, obviously, is the object’s name: IRIDIUM 8, and the first column (numbers 1 and 2 in the above example), simply indicate the row numbers. Easy enough. The next few numbers don’t necessarily indicate the metrics of the satellite’s orbit, but give some details about its history:

-24792U is the satellite’s identification number, and “U” simply reads “unclassified”.

-97920A describes the launch which set the satellite into orbit. Specifically, 97 means 1997 (the launch year), and 020 is the launch number (20th).

We now begin to describe the orbit by first declaring when it started. The first two digits of the fourth column indicate the epoch year, or in this example 12. The digits following that, 013.5316322 in the above example, describe the day and fractional portion of the day on which the satellite’s orbit began.

-.00001036 is the “first time derivative of the mean motion divided by two”. Yes, I know, don’t worry; in the next article we’ll understand what this means.

The remainder of the numbers (no pun intended) on this line aren’t going to weigh in heavily with our computations, but they describe the effects of atmospheric drag on the satellite. While this is important, in the interests of making the math simpler and easier, we’re not going to care about this.

And now we get to the second line and where the real interesting numbers begin. Again, 24792 is the satellite number, but immediately following this is a very important number: the orbital inclination (86.3931 degrees). This is the offset of the orbital plane from the reference plane (refer back to the previous article).

-66.9767 is the right ascension of the ascending node, also in degrees. This is the right ascension (yes, in the sky) of the point at which the ascending node crosses the reference, or equatorial, plane. For us Westerners, this means the point in the sky at which the satellite crosses the equatorial plane “upwards”.

-0002471 is the eccentricity of the satellite’s orbit. If you recall, this simply describes by how much the object’s orbit deviates from that of a perfect circle.

-88.7690 (again, in degrees), is the argument of perigee, or sometimes more generically referred to as the argument of periapsis.

Periapsis is the point of closest approach between the orbiting object and the object which it orbits, and the argument of periapsis is the angle between this closest point and the satellite’s ascending node (see the right ascension of ascending node above).

271.3771 (degrees), is the mean anomaly. The next article will describe this in detail.

The final number is actually a long and drawn out representation of three separate values: the satellite’s revolutions per day, the number of revolutions at epoch, and a checksum. These, again, are of less interest to us in the near term.

Phew. Okay. Next time we’ll dig into a couple of these more deep values and what they mean for a satellite’s orbit. But in the event of an extremely boring dinner party, you can now amaze your friends and family with your knowledge about a really cryptic and complex-looking set of numbers

## Club Events

## ON THE NET

Newsletter submission deadline, February 15, 2012

### PAC Club Meeting

Tuesday January 31, 2012 7:30pm @ Hyde Observatory

Program: How to Use a Telescope

### PAC Meeting

Tuesday February 28, 2012 7:30pm @Hyde Observatory

Program: Mars Exploration Update

### PAC:

[www.prairieastronomyclub.org](http://www.prairieastronomyclub.org)

### PAC E-Mail:

[info@prairieastronomyclub.org](mailto:info@prairieastronomyclub.org)

### NSP:

[www.nebraskastarparty.org](http://www.nebraskastarparty.org)

### NSP E-Mail:

[info@nebraskastarparty.org](mailto:info@nebraskastarparty.org)

### OAS

[www.OmahaAstro.com](http://www.OmahaAstro.com)

### Hyde Observatory

[www.hydeobservatory.info](http://www.hydeobservatory.info)

### 2012 PAC Star Party Dates - Dates in bold are closest to the new moon

January		<b>Jan 20th</b>
February	Feb 17th	<b>Feb 24th</b>
March	Mar 16th	<b>Mar 23rd</b>
April	Apr 13th	<b>Apr 20th</b>
May	May 11th	<b>May 18th</b>
June	Jun 15th	<b>Jun 22nd</b>
July	Jul 13th	<b>Jul 20th</b>
<b>NSP</b>	<b>July 15-20</b>	
August	Aug 10th	<b>Aug 17th</b>
September	Sep 7th	<b>Sep 14th</b>
October	Oct 5th	<b>Oct 12th</b>
November	Nov 9th	<b>Nov 16th</b>
December	Dec 7th	<b>Dec 14th</b>

### Lunar Party Dates:

Apr 27th  
May 25th  
  
Jul 27th  
  
Aug 24th  
Sep 21st

### Panhandle Astronomy Club

[Panhandleastronomyclub.com](http://Panhandleastronomyclub.com)

**PAC-LIST:** You may subscribe to the PAC listserv by sending an e-mail message to: [imailsrv@prairieastronomyclub.org](mailto:imailsrv@prairieastronomyclub.org). In the body of the message, write "Subscribe PAC-List your-email-address@your-domain.com"

For example:

Subscribe pac-list me@myISP.com

To post messages to the list, send to the address

[pac-list@prairieastronomyclub.org](mailto:pac-list@prairieastronomyclub.org)

### Internet Links of Interest

<http://www.spacenews.com/commentaries/111111-guest-blog-apollo-spirit-alive-and-well.html>

<http://www.thespacereview.com>

<http://www.thespacereview.com/article/1945/1>

<http://space.flatoday.net/>

<http://www.spaceportamerica.com/>

<http://spacerefpress.com/2011/09/first-issue-of-space-quarterly-magazine-released.html>

<http://www.nasaspaceflight.com/>

<http://www.spacex.com>

PAC can also be found on Twitter and Facebook.

Buy club apparel through the club website. Shirts, hats, mugs, mouse pads and more.



# January/February Observing: What to View--Jim Kvasnicka

## Planets

Venus: Brightens from magnitude -4.1 to -4.3 in February. Venus continues to get higher and sets about 3½ hours after the Sun.

Jupiter: Look for Jupiter high above Venus to start the month, but will continue to get closer by month's end.

Uranus: On February 9th look for Uranus just south of Venus.

Neptune: Is at conjunction with the Sun on February 19th and not visible all month.

Mars: Doubles in brightness from -0.5 to -1.2. Look for it south of Leo's tail.

Saturn: Rises around 11:30 pm to start the month in Virgo.

Mercury: Becomes visible in the evening late in February.

## Messier List

M1: The Crab Nebula in Taurus.

M35: Open cluster in Gemini.

M36/M37/M38: Open clusters in Auriga.

M42: The Orion Nebula.

M43: Emission nebula just north of M42.

M45: The Pleiades.

M78: Emission nebula in Orion.

M79: Globular cluster in Lepus.

Last Month: M33, M34, M52, M74, M76, M77, M103

Next Month: M41, M44, M46, M47, M48, M50, M67, M81, M82, M93

## NGC and Other Deep Sky Objects

NGC 2264: The Christmas Tree Cluster in Monoceros.

NGC 2362: The Tau Canis Majoris Cluster.

NGC 2392: The Eskimo Nebula in Gemini.

NGC 2403: Oval shaped galaxy in Camelopardalis.

## Double Star Club List

32 Eridani: Yellow and white pair.

55 Eridani: Yellow primary with a pale yellow secondary.

Gamma Leporis: Pair of yellow stars.

Epsilon Monocerotis: White and pale yellow stars.

Beta Monocerotis: Three bluish white stars.

Kappa Puppis: Equal pair of white stars.

Alpha Ursa Minoris: Polaris, Yellow-white primary with a white secondary.

N Hydrae: Equal yellow stars.

## Blast from the Past

### **The Romantic Astronomer - Dave Churilla**

Well, I told Jeff that this article was purely filler. It has no astronomical information, no redeeming social value. So, if you're reading it, it means it was probably a slow month for articles for the newsletter. But I wanted to relate one of the best reasons for enjoying astronomy for me, and I hope for many of you. Enjoy....or at least wake up when you're done with the article.

I smiled as I watched the little 11 year old munchkin try to carry the eyepiece case, chart bag and cooler all at the same time. "Scorpios and Sagittarius will be up tonight, won't they dad?" he struggled to call back over his shoulder, nearly dropping the cooler. "Yep Joey, they sure will be. But that'll be later. We still spend some time galaxy hunting in Virgo first." "Will John be there with the 18?" he grunted as he hoisted the bags into the trunk. "He said he would be" I grinned as I set down our 10" Dob's tube and rearranged things. "Hope Jeff and his son are there, they're fun". I cringed, fearing for Jeff's sanity and safety. "What about Don?" he asked. "He said he'd try" now fearing for Joey's sanity. Loading done, we hopped in the car and headed for Wagon Train Park. The first part of the trip was quiet with Joey running the dial on the radio trying to find something he liked (us old fogies don't always play the right things you know). Finally we began talking about what we were going to see that night, and what fun we'd have.

Ever since Joey and I became involved in the hobby of astronomy and even more so being members of PAC, we've enjoyed the night skies, the rich wonders that we never dreamed we could see with our own two eyes, let alone find in a telescope. One of our favorite times with the hobby are the club Star Parties. This particular night Joey spent roaming around visiting others, looking through their telescopes and talking about the objects. But mostly he just bugged Jeff, which is always fun to watch, or was being bugged by Don, which is usually sweet revenge. Finally tiring of being the social butterfly, he came home to our telescope and sat beside me, sipping a pop. It was time to enjoy each other's company as we explored our favorite constellations, Scorpios and Sagittarius.

I've taken great pleasure in the time I've been able to spend with my son in many activities. We bowl together, we fish, and we enjoy games at home. But probably the most fun I have is when we go stargazing, often times incorporating camping along with it. It's a time to talk together, to enjoy the beauty and majesty of our world and the universe. I've smiled watching Jeff and his son working together to find an object in the telescope and the bond that's between them as they enjoy the night together (if only stargazing wasn't so exhausting as Aaron usually falls asleep before things are done).

I think the most fun I've ever had was one lonely night at Olive Creek. It was just Joey and I and we didn't know much about what we were doing. The moon shown brightly in the sky (we weren't too swift at figuring out when it would be out yet...now I'm a lot smarter...I ask Jeff!) and dashed our hopes of a dark sky to view into. Joey was really disappointed, and nearly wanted to go home. I consoled him, shaking my fist at the moon and pretending to do a witch doctor dance to get rid of it...he laughed hysterically, mostly because of my great coordination as I stumbled and fell down. We decided to use the night to try and see some clusters in Auriga, Gemini, Canes Major and Minor. We found one...Joey practiced finding it again. Then we found another...more practice. That night we found 23 Messier objects and had the best time together. We were learning more about the hobby, how to find things, and how to work together. We were proud of ourselves, but I think the best part was being together. I let Joey do most of the searching, partly because he's better at finding most things anyway, but mostly because it was fun watching him. I became the chart navigator, the eyepiece changer, the flashlight holder and the pop getter. In the space of about 3 hours a little boy, well, ok, 2 little boys, were transformed into amateur astronomers, gaining more experience than we had in the past 4 weeks.

I look forward to every time Joey and I go out. I can see that Jeff does too (with Aaron I mean...I'm sure he'd prefer to have Joey bound and gagged!), as well as the other parents I see doing something with their sons or daughters with club activities. I think it's great. I sometimes worry that Joey is making a pest of himself at the Star Parties, but everyone assures me he isn't (but then, I don't know what Joey's bribed them with). I enjoy the other kids that come out and would love to see more. Perhaps a youth Star Party would be in order, to teach, to have fun, and to be together. It's a thought....

*This article appeared in the September 2000 issue of the newsletter*

## ANNUAL MEMBERSHIP

**REGULAR MEMBER - \$30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.**

**FAMILY MEMBER - \$35.00 per year. Same as regular member except gets 2 votes at club meetings.**

**If you renew your membership prior to your annual renewal date, you will receive a 10% discount.**

**Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.**

## Club Telescopes

To check out one of the club telescope contact **Jason Noelle**. If you keep a scope for more than a week, please check in with Jason once a week, to verify the location of the telescope and how long you plan to use it. The checkout time limit will be two weeks, but can be extended if no one else has requested use of a club scope.

100mm Orion refractor:  
**Available**

10 inch Meade Dobsonian:  
**Checked Out**

13 inch Truss Dobsonian:  
**Available**



## Program Chair Minute - Dave Churilla

This month's PAC Meeting will be on Tuesday, January 31st. As usual we'll have a short business meeting at 7:30 PM which will include Observing Chair Jim Kvasnicka's Observing Report followed by the evening's program, "How to Use Your Telescope", hosted by PAC.

This is our annual program to help the people who have new scopes and need basic help to learn to use them. There will be a very short presentation and then we'll have our guests talk to members of the club to answer questions one on one about their scopes. We'll need as many club members as we can there to help out with the event. It would also be good to bring tools to help collimate or adjust our guest's telescopes with. Jack Dunn will be putting out publicity for the event.

Following are upcoming programs that we have planned or are in the process of planning that you won't want to miss.

### **Feb 2012: Update on Mars Exploration**

Jack Dunn will be giving us a multimedia update on Mars exploration.

### **Mar 2012: Fun Astronomy Night (still working on this program)**

The Executive Board will present a humorous look at the media, film, and astronomy supplemented with a star party if the weather cooperates. Snacks might be available. We're still working on this program so stay tuned for details.

### **Apr 2012: Astronomy and the Internet (still a working title)**

Dale Bazan is working on a presentation on astronomy and the internet. More to come as he refines the topic.

**May 2012: Tentative: Near Star Party:** We are considering another Near Star Party that will begin early and go until about 8:00 PM with the business meeting afterward. We'll let you know.

**June 2012: BBQ Social (tentative)** We are considering once again a BBQ social perhaps featuring Cajon Bob's Pulled BBQ Pork and an enjoyable evening of visiting with one another. Stay tuned for more info.

I'll try to keep you apprised of upcoming programs so you can plan to attend.

The members of the PAC Executive Committee work together to plan the monthly PAC Programs. Our goal for the programs is to provide a good mix of information, entertainment (including time to visit with one another), and to make them relevant for all experience levels as well as to hit all interests in astronomy. In addition we want to get club members involved with giving presentations as there is a lot of expertise in different areas that we all could benefit from. So we would love to have your comments and suggestions concerning what you would like see in our programs. Call me at 402-467-1514 or email me at [weber2@inebraska.com](mailto:weber2@inebraska.com).

## Challenge Observing Objects for January/February

Each month I will have two objects, one for the more seasoned observer and one for the beginning observer. Each object I hope will challenge you just a little bit. I will provide you with a little bit of information about the object. It is your job to find it and if you would write a little report or draw what you see. The first person to report back on each object will have their report published in the next issue of the newsletter. Happy Hunting!

### Advanced Object

#### NGC 2438

NGC 2438 is a planetary nebula about 3,000 light years away in the constellation Puppis. It was discovered by William Herschel on March 19, 1786. The planetary nebula NGC 2438 appears to lie within the cluster M46, but it is most likely unrelated since it does not share the cluster's radial velocity. The central star of this planetary nebula is a 17.7-magnitude white dwarf, with surface temperature of about 75,000 K (74,700 °C). It's one of the hottest stars known.



### Beginner Object

#### NGC 1662

NGC 1662 is a small open cluster located in Orion. An 8-inch scope will show about 30 stars, with the brightest outlining a heart shaped figure. The 2 lobes of the heart are joined by a loop of 4 stars that are part of the multiple star h684, with the brightest being the yellow star. The cluster reminds me of a Klingon Bird of Prey from Star Trek. It has a apparent magnitude of 6.4



## Crucial Rocket Firing Puts Curiosity on Course for Martian Crater Touchdown by Ken Kremer of Universe Today

ASA's car-sized Curiosity Mars Science Lab (MSL) rover is now on course to touch down inside a crater on Mars in August following the completion of the biggest and most crucial firing of her 8.5 month interplanetary journey from Earth to the Red Planet.

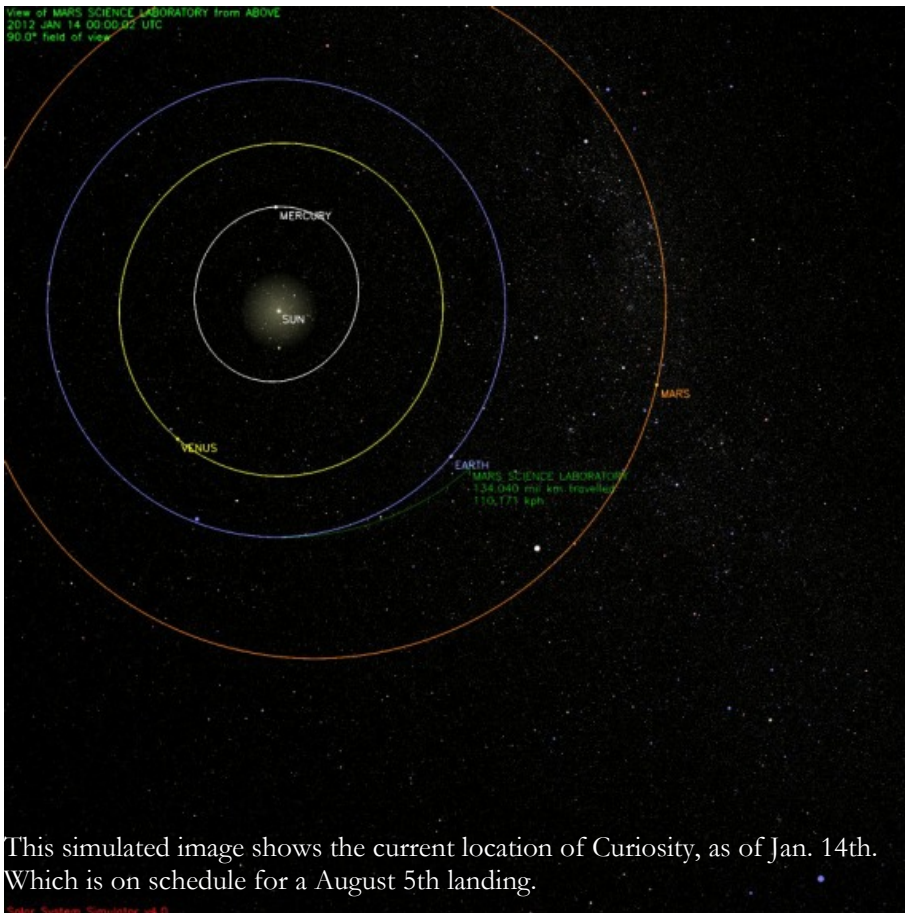
Engineers successfully commanded an array of thrusters on MSL's solar powered cruise stage to carry out a 3 hour long series of more than 200 bursts last night (Jan. 11) that changed the spacecraft's trajectory by about 25,000 miles (40,000 kilometers) – an absolute necessity that actually put the \$2.5 Billion probe on a path to Mars to “Search for Signatures of Life !” “We've completed a big step toward our encounter with Mars,” said Brian Portock of NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif., deputy mission manager for the cruise phase of the mission. “The telemetry from the spacecraft and the Doppler data show that the maneuver was completed as planned.”

Mars Science Lab and cruise stage separate from Centaur upper stage just minutes after Nov. 26, 2011 launch. Thrusters on cruise stage performed course correction on Jan. 11, 2012. Up to 6 firings total will put the NASA robot on precision course to Mars. This was the first of six possible TCM's or trajectory correction maneuvers that may be required to fine-tune the voyage to Mars. Until now, Curiosity was actually on a path to intentionally miss Mars. Since the Nov. 26, 2011 blastoff from Florida, the spacecraft's trajectory was tracking a course diverted slightly away from the planet in order to prevent the upper stage – trailing behind – from crashing into the Red Planet. The upper stage was not decontaminated to prevent it from infecting Mars with Earthly

microbes. So, it will now sail harmlessly past the planet as Curiosity dives into the Martian atmosphere on August 6, 2012.

The thruster maneuver also served a second purpose, which was to advance the time of the Mars encounter by about 14 hours. The TCM burn increased the velocity by about 12.3 MPH (5.5 meters per second) as the vehicle was spinning at 2 rpm. “The timing of the encounter is important for arriving at Mars just when the planet's rotation puts Gale Crater in the right place,” said JPL's Tomas Martin-Mur, chief navigator for the mission. As of Jan. 12, the spacecraft has traveled 81 million miles (131 million kilometers) of its 352-million-mile (567-million-kilometer) flight to Mars. It is moving at about 10,300 mph (16,600 kilometers per hour) relative to Earth, and at about 68,700 mph (110,500 kilometers per hour) relative to the Sun. The next trajectory correction maneuver is tentatively scheduled for March 26, 2012.

The goal of the 1 ton Curiosity rover is to investigate whether the layered



This simulated image shows the current location of Curiosity, as of Jan. 14th. Which is on schedule for a August 5th landing.

terrain inside Gale Crater ever offered environmental conditions favorable for supporting Martian microbial life in the past or present and if it preserved clues about whether life ever existed. Curiosity will search for the ingredients of life, most notably organic molecules – the carbon based molecules which are the building blocks of life as we know it. The robot is packed to the gills with 10 state of the art science instruments including a 7 foot long robotic arm, scoop, drill and laser rock zapper.



**1.) Living on the ISS is sometimes said to be a difficult experience – if you could make any one change to the ISS to make it more comfortable, what would it be?**

Mike Fossum: “Get the transporter working – it would be great to be home for the weekend.” Fossum also added, “I loved living and working there (The ISS) and there’s very few things I’d change. I had a great window view and my own personal quarters. I guess if anything I missed being able to sit in a chair – that and being able to have a cup of coffee (instead of out of a bag) and read the newspaper in the morning.”

**2.) As a trained astronaut, what are your thoughts on the feasibility of making space flight a routine for normal civilians ( besides tourists) especially with regard to interplanetary/beyond earth orbit flights?**

Mike Fossum: “I think we’ll see low Earth-orbit very soon.” Fossum also mentioned, “I was born a few months after Sputnik’s launch, the changes in spaceflight over the past 54 years are staggering. The potential for changes over the next fifty years is unimaginable.” Fossum also had a parting thought on the rise of commercial space travel, “I have a nagging voice telling me to say “be careful”, we’ve learned hard and costly lessons”.

**3.) While in the Earth’s shadow, could you see the stars, constellations and planets? If you could, did they look any better or brighter?**

Mike Fossum: “Oh, Yes! The key is to be in a place where you can dark adapt – any sunlight overpowers night vision.” Fossum mentioned that during some “down” time on a spacewalk, he was able to turn off his helmet lights and immerse himself in the “3-d feeling” of being in the stars. Describing the quality of the views, Fossum stated, “The Milky Way was clear, and no twinkle in stars. The different colors of stars were more intense”.

**4.) After a typical stay on the ISS, how long does it take an astronaut to recover from the effects of weightlessness?**

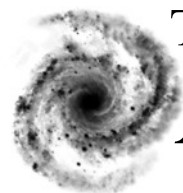
Mike Fossum: “There’s a great deal of recovery in the first three weeks. Balance, running, walking, I’d say I’m at about 90%” Fossum mentioned one other side effect of his stay on the ISS – apparently he’s in better physical shape than before he left. Fossum speculated that the improvements in his physical shape were due to the rigorous exercise routines he performed during his stay on the ISS.

**5.) What would you say is the strongest asset that each of the space fairing countries brings to the table when it comes to our forward progress into space as a species?**

Mike Fossum: “The Russians have a different design process than we (The United States) do. They evolve, rather than start over.” Fossum added, “Looking at their station module design, they took stuff that worked from MIR and improved upon it, they analyzed and tested and broke stuff and added more steel. Americans analyze and analyze – it was a real shock to NASA on how Russia built things.” Fossum mentioned that in 2008, he helped install the JAXA Kibo module on the International Space Station and was impressed by the efficiency of JAXA engineers.

Regarding some of the other partner nations participating in the ISS, Fossum mentioned, “ESA has the best of German efficiency and Italian flexibility.” Fossum also discussed the Canadians niche in robotics, stating that they’ve been leaders who are proud of their work. Fossum cited the success of the remote manipulator arm on the space shuttles, as well as the “big arm” on the ISS and the DEXTRE manipulator.

Fossum shared a final thought regarding all the nations participating in the ISS, stating, “There’s a common passion for space among the big partners on the ISS.” Fossum also mentioned to “Look at history” regarding Russia, Germany, Italy, Japan and the U.S, emphasizing that nations who were at war with each other not that long ago are working together to achieve common goals in space.



# THE *Prairie* *Astronomy* *Club*

Amateur Astronomy --  
A Hobby as Big as the Universe

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular \$30/yr, Family \$35/yr.** Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585.** For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: **Jason Noelle at [oegrad2002@yahoo.com](mailto:oegrad2002@yahoo.com)**, no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.

<b>PRESIDENT</b>	<b>Dan Delzell</b> 402-432-6283 <a href="mailto:dan@delzell.net">dan@delzell.net</a>
<b>VICE PRESIDENT</b>	<b>Jason Noelle</b> 402-730-8317 <a href="mailto:Oegrad2002@yahoo.com">Oegrad2002@yahoo.com</a>
<b>2nd VP (Program Chair)</b>	<b>Dave Churilla,</b> 402-467-1514 <a href="mailto:weber2@inebraska.com">weber2@inebraska.com</a>
<b>SECRETARY</b>	<b>Dale Bazan</b> <a href="mailto:dale.bazan@gmail.com">dale.bazan@gmail.com</a>
<b>TREASURER</b>	<b>Bob Kacvinsky</b> 402-423-4967 <a href="mailto:bob.kacvinsky@syngenta.com">bob.kacvinsky@syngenta.com</a>
Club Observing Chair:	<b>Jim Kvasnicka</b> <a href="mailto:jim.kvasnicka@yahoo.com">jim.kvasnicka@yahoo.com</a>
Outreach Coordinator:	<b>Kris Gainsforth</b> <a href="mailto:krisguy@krisguy.com">krisguy@krisguy.com</a>
Website Editor:	<b>Mark Dahmke</b> (402) 475-3150
Publicity:	<b>Jack Dunn</b> <a href="mailto:jdunn@spacelaser.com">jdunn@spacelaser.com</a>

The Prairie Astronomer  
c/o The Prairie Astronomy Club, Inc.  
P.O. Box 5585  
Lincoln, NE 68505-0585

FIRST CLASS MAIL

**Next PAC Meeting**  
**Tuesday**  
**January 31, 2012**  
**7:30 PM**  
**Hyde Observatory**