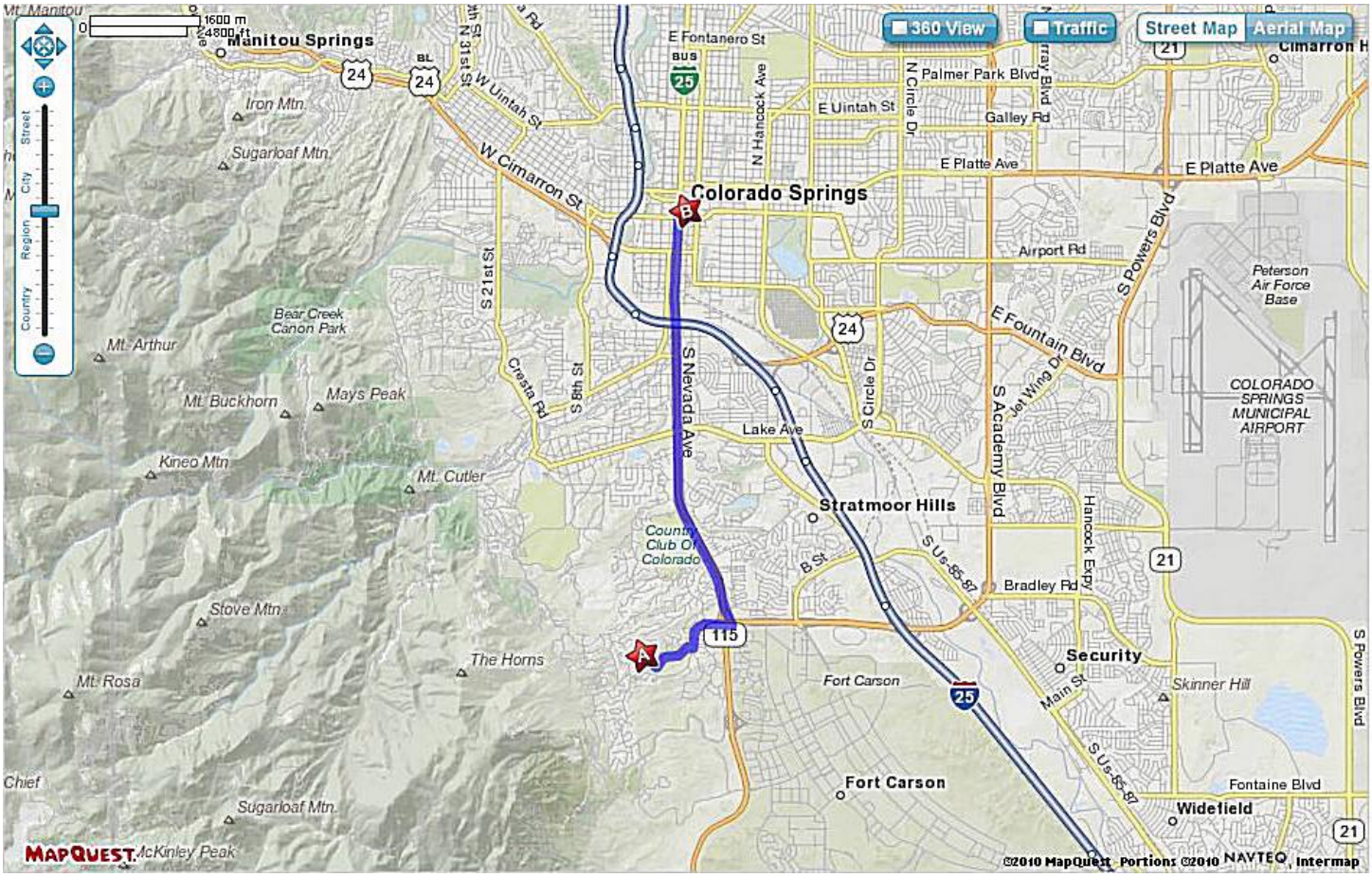
The Hypoxic Observer©

February 2010

February's Meeting location



February's meeting will be held in Firehouse #16 located at 4980 Farthing Drive, Oak Meadow Park, Broadmore Bluffs. This is the first time that we will be meeting here, so plan to leave home a bit earlier than usual to make finding it less stressful.

Our program will include the popular "Show-and-Tell". It gives everyone a chance to share items or resources which they find particularly helpful when they enjoy astronomy.

IMHO - Editorial

The recent cancellation of NASA's future space vehicle program that would have returned us to the moon, is in my own opinion short sighted and detrimental to our economic recovery. I am not saying this to denigrate the current administration, I say this because I believe that this decision will have dire consequences for future generations.

Our country will literally take a back seat to our competitors in space (Russia, and China), who are fortunate enough to keep their eyes on their target of building a space program which will put them in the driver's seat (figuratively and literally).

Projected "savings" will not get us out of the poor house economically. Add to this the wasted labor and engineering spent to qualify the next generation of hardware (which recently passed their initial certification of readiness); and you are seeing a *"baby being thrown out with the bath water"* of great magnitude.

What will the world believe when the Chinese show their flag on the moon; and that they "...found no trace of US landings."? Will the moon be claimed as a state of China (as they now claim Taiwan?). Will history have a side note that the US failed to keep it's lead in the development of the commercial gold mine that space offers?

My hope is that the potential profit of space will be incentive enough for business' to expand their role and interest in space. As long as they rely on the government for all of the hardware and experience; that potential will never be realized. Let's face it, resources on this earth are pretty well divided and claimed by some body, some place. The only true resources yet untapped are out there in space. When those resources become accessible and affordable; they too will be claimed by those who can first reach them. Will we get to share in that acquisition, or will we be stranded here watching on the sidelines?

As Sir Arthur Clarke once wrote: *"Perhaps one day men will no longer be interested in the unknown, no longer tantalized by mystery. This is possible, but when man loses his curiosity, one feels he will have lost most of the other things that make him human....The challenge of the great spaces between the worlds is a stupendous one; but if we fail to meet it, the story of our race will be drawing to a close. Humanity will have turned its back upon the still untrodden heights and will be descending the long slope that stretches, across a thousand million years of time, down to the shores of the primeval sea*."

I would prefer that we reach for the stars, than go for a swim in that sea.

Planetary Report

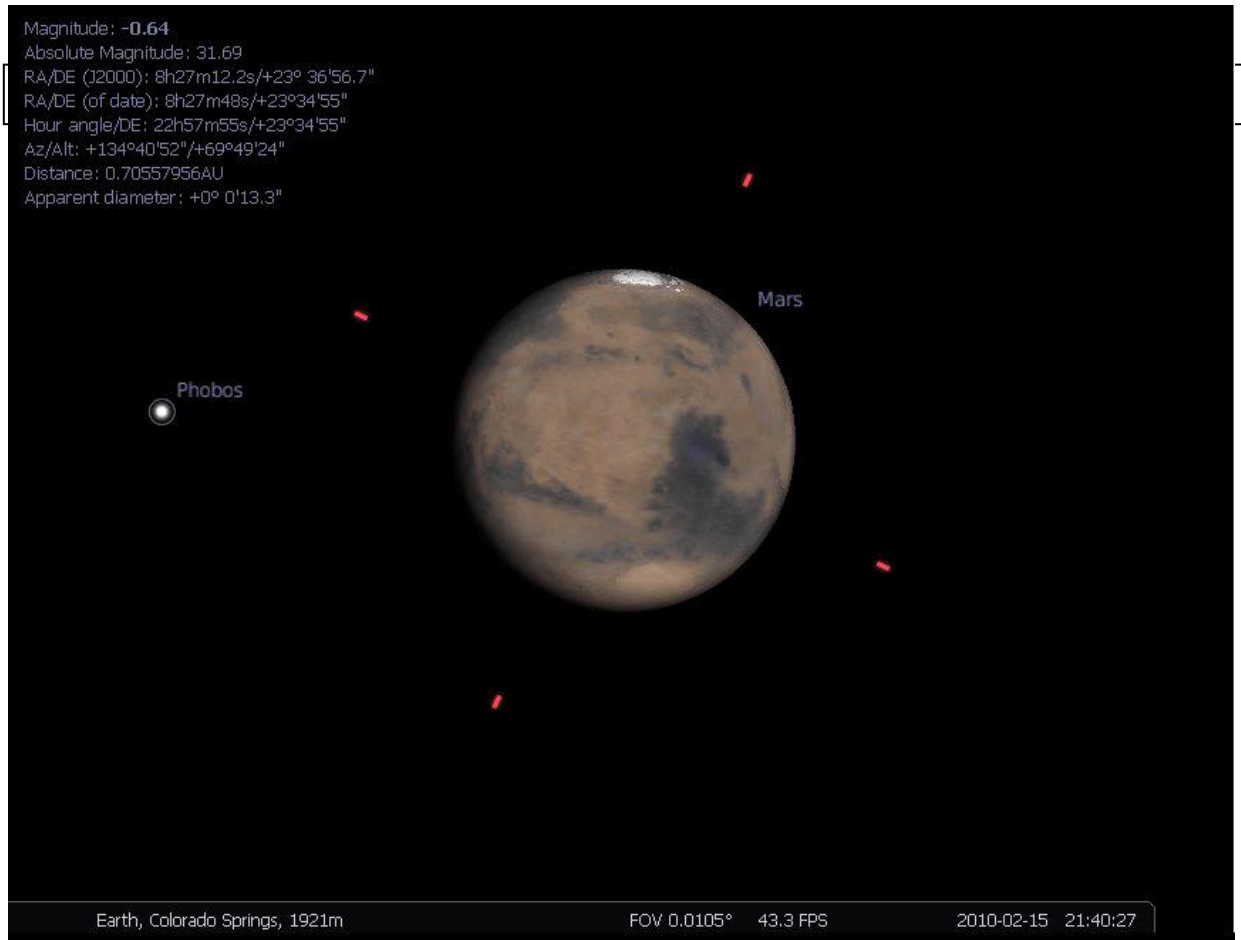
Our nearest neighboring planet, Mars, is now gaining more distance from us each day. It will remain larger than ten arcseconds in diameter until late March, the 22nd to be specific. Until then, you still have a chance at taking a nice photo of Mars and it may show some surface details ('seeing' permitting) - see next page.

The upper picture is a “save” from the program Stellarium. It records details for the second picture which was taken on 15 Februaury 2010. It is a convinent way to keep track of the size, brightness, and statistics for your efforts. As you can easily see, the 'seeing' conditions were not very good that night. Despite clear transparent skies, the turbulent atmosphere made the features of Mars barely distinguishable.

Venus, our other neighbor, is as far from the sun, as Mars is from Earth. It is on the other side of the sun in its orbit. Jupiter, which is also in that same direction, has become unobservable due to its proximity with the sun. Mercury is in that general area, and is also unobservable.

Saturn on the other hand, is gaining prominence as it heads towards it's nearest approach of Earth on the 21st of March. It will not be at it's brightest (since its rings are still somewhat edge-on to Earth); but this too will improve as we head into April and May. So get your cameras ready, and ask Saturn to say “Cheese”!

Both Uranus, and Neptune are beyond the sun and are unobservable. Out of the eight planets; five of them are in that situation. Mercury and Venus do not tarry there, and will return to viewable status quit soon.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Absolute Magnitude: 31.69
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RA/DE (of date): 8h27m48s/+23°34'55"
Hour angle/DE: 22h57m55s/+23°34'55"
Az/Alt: +134°40'52"/+69°49'24"
Distance: 0.70557956AU
Apparent diameter: +0° 0'13.3"
Mars
Phobos
Earth, Colorado Springs, 1921m
FOV 0.0105°
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Single-Crystal Silicon Mirrors

A Process for Producing High-Quality, Lightweight Mirrors

A patent-pending process using single-crystal silicon

NASA Goddard Space Flight Center invites companies to license its new, patent-pending process that helps significantly reduce the risk, time, and costs associated with producing lightweight mirrors for demanding instrument applications. The method employs a solid disc of single-crystal silicon (SCS) and calls for most of the polishing to be completed before lightweighting. Due to the extraordinary homogeneity of SCS, the distortion caused by traditional lightweighting processes is significantly reduced.

Benefits

- **Robust:** In Goddard's process, the SCS disc is polished first, while it is still a robust solid blank and before any lightweighting is done, eliminating the possibility of print-through from the support structure.
- **Thin:** The face sheet of the optic can be thinner than those used in traditional designs because it does not need to withstand subsequent mechanical polishing after the optic has been lightweighted.
- **Cryogenic-tolerant:** SCS mirrors exhibit very little or no distortion when cooled to cryogenic temperatures due to high thermal conductivity, low thermal expansion, and extreme homogeneity.
- **High quality:** SCS hardness and homogeneity allows mirrors of exceptional optical quality to be made using conventional polishing techniques. Typical surface figures are better than $1/50^{th}$ wave RMS at 633nm.
- **Cost-effective:** Silicon can be polished directly for visible and ultraviolet applications, eliminating the need for a cladding layer. This simplifies fabrication and reduces costs.

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Applications

Goddard's technology is ideal for use in environments in which lightweight, cryogenic operation, or high heat dissipation is required. The SCS technology provides a cost-effective solution for applications including:

- **Space-based imaging systems**
- **Military reconnaissance**
  - Satellite and unmanned aerial vehicles (UAVs)
- **Fast-scanning or -steering mirrors**

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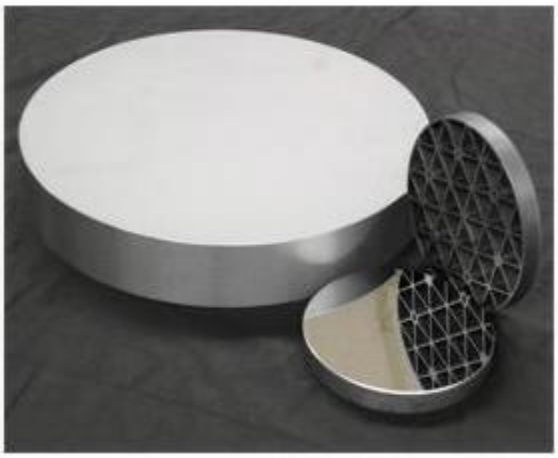
Technology Details

How it works

SCS lightweight mirrors typically weigh about one-fourth that of a solid quartz blank of the same size, making them useful for a variety of instruments where weight is a concern. Each mirror is a monolithic structure consisting of a face sheet with a highly polished front optical surface and a lightweight support structure.

In Goddard's process, the optical surface is formed in a solid SCS blank either by conventional grinding and polishing or by diamond turning. An element is temporarily attached to protect the optical surface during the lightweighting process. The blank is then lightweighted using abrasive machining, ultrasonic machining, or a combination of both. The temporary protector is then removed, and for most applications, the mirror is then ready for use. For critical applications, post-lightweighting polishing can be performed to further improve the optical surface. Due to the very small amount of material removed during this step, it produces no quilting or print-through of the lightweight support structure. At several points during the process, the mirror is heated to near its melting point to remove small crystalline defects caused by the fabrication process.



Each resulting SCS mirror is a monolithic structure formed from a single crystal of silicon, giving it a homogeneous composition free of internal stress. These parameters inhibit distortion when cooling the mirror to cryogenic temperatures. Under such conditions, the mirrors maintain their optical figure to 1/50th wave root mean square (RMS) or better. At room temperature, SCS has a thermal conductivity about the same as aluminum and a thermal coefficient of expansion about equal to Pyrex® glass. So SCS mirrors are extremely resistant to thermal shock and ideal for applications where high heat dissipation is required. Goddard has produced 11 SCS mirrors so far, ranging in size from 10cm (4") to 25cm (10"). The process can produce quality mirrors up to 40cm (16") in diameter, and the ultimate size, limited by the diameter of high-quality SCS boules, is about 50cm (20").

Why It Is Better

Virtually all conventional lightweight mirrors are made by optically grinding and polishing an already lightweighted blank. Mirrors made this way always risk print-through to the optical surface from the underlying support structure. In some cases this can be removed by a zero-pressure process, such as ion-beam polishing, although these processes tend to be slow and costly. Lightweighting after optical polishing is not an option for conventional materials as their inhomogeneous qualities and internal stresses cause the lightweighting to distort the optical surface.

By contrast, in Goddard's process for SCS mirrors, optical grinding and polishing is done before lightweighting, eliminating the possibility of print-through. This is due to the extreme homogeneity and absence of stress possible in a monolithic structure from a single crystal. This results in a simple and cost-effective process that is capable of producing mirrors of exceptional quality.

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Patents

NASA Goddard Space Flight Center is seeking patent protection for this technology.

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Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program Office, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the **Lightweight Optical Mirrors Formed in Single-Crystal Silicon technology (GSC-14393-1)** for commercial applications.

For information and forms related to the technology licensing and partnering process, please visit the Licensing and Partnering page. (Link opens new browser window)

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For More Information

If you are interested in more information or want to pursue transfer of this technology (GSC-14393-1), please contact:

Innovative Partnerships Program Office
NASA Goddard Space Flight Center
E-mail: techtransfer@gsfc.nasa.gov

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Upcoming events for March and early April :

Wednesday, March 10 6:00pm USAFA Star Party

Tuesday, March 23 7:00pm Monthly Meeting

Friday, March 26 7:30pm Public Star Party (Bear Creek)

Wednesday, April 14 7:00pm Space Foundation Symposium Star Party

Monday, April 19 - Sunday, April 25 National Week of Astronomy

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