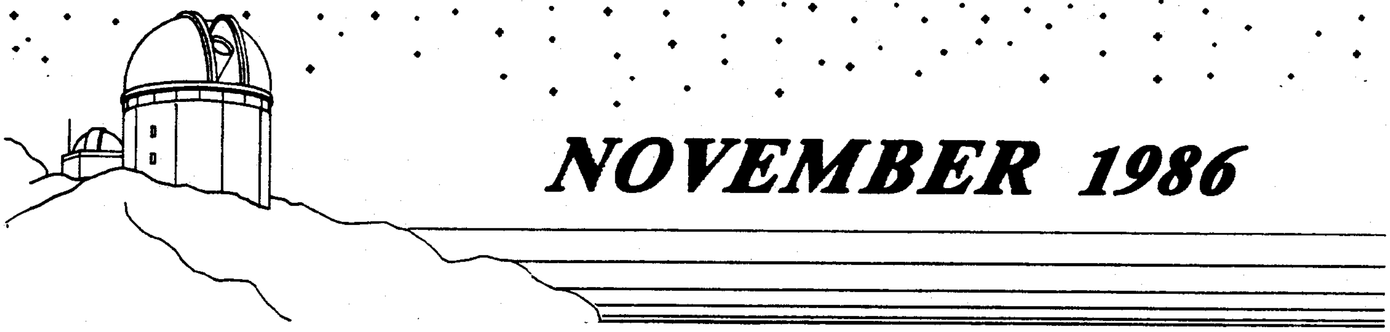
EPHEMERIS

OF THE SAN JOSE ASTRONOMICAL ASSOCIATION



NOVEMBER 1986

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* NOVEMBER 22ND 8 PM *

* "A DOWN UNDER LOOK AT HALLEY'S COMET" *

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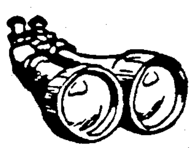
NOVEMBER	1	FIELD EXPEDITION TO HENRY COE STATE PARK. DUSK TILL DAWN. GRANT RANCH WAS UNAVAILABLE.
NOVEMBER	8	INDOOR STAR PARTY 8 PM AT THE LOS GATOS RED CROSS BUILDING
NOVEMBER	15	BOARD MEETING 7 PM AT THE LOS GATOS RED CROSS BUILDING. INTRODUCTORY ASTRONOMY CLASS TO MEET AT RED CROSS AT 8 PM AND THEN MOVE TO THE WEST VALLEY PLANETARIUM.
NOVEMBER	22	GENERAL MEETING 8 PM. "A DOWN UNDER LOOK AT HALLEY'S COMET" PRESENTED BY ERNIE PIINI.
NOVEMBER	29	FIELD EXPEDITION TO HENRY COE STATE PARK. DUSK TILL DAWN.
DECEMBER	6	BOARD MEETING 7 PM AT THE LOS GATOS RED CROSS BUILDING. INDOOR STAR PARTY TO FOLLOW AT 8 PM.
DECEMBER	13	GENERAL MEETING 8 PM. SPEAKER TO BE ANNOUNCED

FIELD OF VIEW
BY: JOHN GLEASON

NOVEMBER 22ND GENERAL MEETING



Eclipse chaser, world traveler, SJAA member, Ernie Piini will present another of his famous travelogues that will take us "down under" to Australia to observe Halley's. Ernie always provides a lot of fun and entertainment, so come early for a good seat.

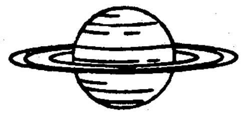
ASTRO CLASS TO MEET AT WEST VALLEY PLANETARIUM

The November 15th Introductory Astronomy Class will be using the West Valley College Planetarium for this evenings training. All members of the class are asked to meet first at the Los Gatos Red Cross at 8PM for directions to the Planetarium. The group will then caravan over to the planetarium which is only 10-minutes away.

ASTRO ADS

WANTED: Standard Questar with Special Coatings. Cervit Mirror preferred, but will accept standard Pyrex mirror model with Special Coatings. Contact: Paul Mancuso (408) 946-0738

THE CELESTIAL TOURIST SPEAKS
BY: JAY REYNOLDS FREEMAN



One critical aspect of telescope performance for deep-sky observing is how dark the field of view is. I believe that most telescopes fall very short on this parameter, simply for want of adequate baffling against stray light. To illustrate my point, I propose the following test:

Take your telescope outside in the daytime, and set it up for observing where there is plenty of glare, but out of direct sunlight. Make sure it is collimated. With no eyepiece installed, point the instrument at empty sky, press your eye to the focuser tube, and look through. What do you see? Move your eye from side to side, so that you get a view along the inside wall of the focuser, and see if anything changes.

You will certainly see a circle of sky-colored light,that came through the objective of your instrument. Depending on what kind of telescope you have, this circle may be partially blocked by diagonal or secondary mirrors, secondary support structures, and what not. If you have a reflector or a catadioptric instrument, the very center of the circle may contain a reflected image of your own eye, gazing steadfastly back at you.

But everything else should be PITCH BLACK, even in full daylight. There are no excuses and no exceptions. The purpose of a telescope is to create an image of a distant object by light that passes through its optical system. Any light that reaches the focal plane from any other source whatsoever will brighten the background, reduce contrast, and make faint fuzzies hard to see. Any light leaks, any glare, or any areas that are gray and not black, are problems that should be eliminated. I suggested performing this test by day only to make obvious what the sources of stray light are, and what to do about them.

Before you start thinking that a full-daylight test is too harsh, note that a conventional refracting telescope with blackened insides and decent internal baffling will pass with ease. Only a few annular baffles, spaced at intervals within the tube, will do the job. I suspect that the acknowledged good performance of many small refractors on deep-sky objects is due to such baffling. (You do need the baffles, though. Cheaper refractors my have none.)

But most telescopes fall down considerably. Besides inadequate baffling, they often suffer from the fact that many "black" coatings are not really very black, particularly at the shallow, grazing angles of incidence involved in squinting through long straight telescope tubes. Let me discuss some common problems.

Many Newtonians have a glaring (*ahem*) deficiency at the bottom end of the tube: there is clear space between the edge of the mirror cell and the inside wall. IN the test just mentioned, you will be able to se around the primary mirror to you lawn or patio. But your telescope is for looking at stars, not grass! The fix is obvious -- get an opaque cap for the bottom of the tube, and put it on when you are observing faint objects. (I wouldn't make it permanent: when observing bright objects at higher magnification, there might be times when tube currents allow a steadier image with the bottom cap off.) If your dust caps are opaque, or can be make so, use one of them.

Again with Newtonians, the far wall of the tube -- opposite the focuser -- is often a problem. From the eyepiece position, some lines of sight go past the diagonal holder to this surface. The tube wall here is not far from the open end of the tube, in a position where stray light may shine obliquely on it and then scatter into the eyepiece. Such places make the difference between a good and poor quality of black very obvious: if moonlight or streetlights shine diagonally into the upper end of the tube, these surfaces can get pretty bright. The metal parts of the diagonal holder are also occasionally not black enough, with similar consequences.

One fix is to try different kinds of the black substances. You don't need to repaint anything till you are certain -- you might prepare a card with stripes of different kinds of black coatings, and tape it inside the tube at various problem spots to see what looks darkest. Another fix is to make a lightweight extension for the upper end of the tube -- something like the dewcaps for Schmidt-Cassegrains.

The inside of the focuser tube is often quite shiny. Many focusers are made of fancy chromed parts, and even black-anodized surfaces reflect a lot of light at shallow angles. The problem here is with light that comes through the optical system properly, but sufficiently far off-axis to miss the field lens of the eyepiece. The metal parts of the focuser and eyepiece should absorb this light, not reflect it back into the field of view. You might try sticking black felt on the inside of the inboard end of your focus tube. Measure carefully so as not to interfere with any eyepiece barrel.

Schmidt-Cassegrains and Maksutovs have a different problem: if you move our eye off the center line of the focus tube for such an instrument, you can often sight right past the secondary mirror, through the corrector, to the sky. The fix involves extending or reshaping the baffle tube that passes through the primary mirror, or attaching a black disc that is large than the secondary to the center of the corrector, or both. Many manufacturers at least make some effort to baffle their instruments correctly. It is hard to get rid of all the light you don't want without also cutting off some of the light you do want, so most such designs are compromises. I would be easy to experiment with a few discs of black cardboard, stuck to the outside of the secondary support with loops of Scotch tape.

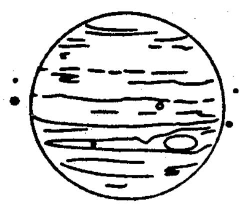
The inside of the baffle tube of a compound telescope is also a likely place for unwanted grazing incidence reflections. These tubes can have refractor-style internal baffles installed. Questars are so constructed, and Questar does a good job: they used to run ads with cut-away views showing how it was done.

Open-tube telescopes have remarkable problems with baffling. Most professional open-tube instruments are used in nearly-enclosed observatory buildings that are pretty good baffles in their own right, but amateurs in the field do not have such luxuries. Fixes involve adding lightweight black surfaces at just the right places, such as across the tube from the focuser or behind the primary mirror. Annular baffles attached around the outside of the tube framework can also help, though these are often clumsy. The "box" part of the popular box and truss tube style is a good place to get busy with high quality black coatings.

A few of these fixes may substantially improve your ability to observe faint and low-contrast deep-sky objects.

CALICO OBSERVATORY
BY: JIM VAN NULAND

JUPITER'S GREAT RED SPOT



Comparison with predictions and SKY and TELESCOPE magazine show good agreement with my own predictions, but the Great Red Spot doesn't read either of them! It continues its wondering by about ±5 minutes. My graph of 1986 data resembles the lunar highlands.

Some observers have expressed doubts as to whether they are seeing the "Red" Spot. It has been very pale this year, showing traces of color only during moments of best seeing; and then little color at that. Study the photo on page 74 of October ASTRONOMY magazine. Note the small indentation in the right-hand belt - just below center, as seen from the bottom of the page. That's the Red Spot Hollow as seen under fair to poor seeing. There will be moments when the air is steady, and the Spot will suddenly be visible. Not obvious, but rewarding those who persist.

Great Red Spot on Meridian PST

da	mo	d	h	m		da	mo	d	h	m		da	mo	d	h	m	
Sa	11	1	9	49	pm	F	11	14	5	35	pm	F	11	28	7	16	pm
Su	11	2	5	39	pm	Sa	11	15	11	22	pm	Su	11	30	8	52	pm
M	11	3	11	27	pm	Su	11	16	7	16	pm	Tu	12	2	10	29	pm
Tu	11	4	7	25	pm	Tu	11	18	8	54	pm	W	12	3	6	21	pm
Th	11	6	8	58	pm	Th	11	20	10	34	pm	F	12	5	8	5	pm
Sa	11	8	10	34	pm	F	11	21	6	26	pm	Su	12	7	9	40	pm
Su	11	9	6	25	pm	Su	11	23	8	8	pm	M	12	8	5	31	pm
Tu	11	11	8	9	pm	Tu	11	25	9	39	pm	W	12	10	7	9	pm
Th	11	13	9	47	pm	W	11	26	5	34	pm						

The times in the table are the moment when the Spot will be facing directly toward the Earth, best placed or observations. Expect to see the Spot an hour before and after the tabular times.

With Saturn near the Sun, and Mars gotten rather small, Jupiter is the main attraction in the planetary show. Best, Jupiter is larger than it has been for some years, and is fine even in smaller scopes. However, the Great Red Spot is not the only activity on Jupiter! Give it a look any time you have the chance, as there are white spots, very prominent at times.

OBSERVING A SHADOW CAST BY JUPITER
BY: DON MACHHOLZ

In the past I've written how one can observe a shadow cast by the planet Venus. Under excellent conditions one can even see the ripple effect similar to shadow bands. I have now seen that Jupiter is presently bright enough to cast a shadow too.

It was this past August when I first tested this. Jupiter was brilliant and high in the sky, and I was comet hunting at Loma Prieta. Low clouds were below me, blocking out all manmade lights. By counting 25 stars in the Great Square of Pegasus I knew my limiting magnitude was 6.3.

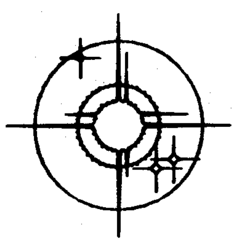
My procedure was simple. I held out my clipboard (which contained white paper) perpendicular to Jupiter and placed my hand a couple of feet above it. By waving my hand slightly I was able to see its well-defined shadow cast upon the paper. Once I noticed the shadow, it became visible even when I wasn't moving my hand. Shortly I was able to count the number of fingers being held up. This last is probably the most difficult test of all.

A couple of weeks later I tried it again, but from a different location, where my limiting magnitude was 6.4. A shadow was again visible. Finally, this morning, back at Loma Prieta and with a limiting magnitude of 6.1, I again saw the shadow cast by Jupiter. I've also tried to observe a shadow cast from the star Vega but I haven't yet been able to discern this.

I would like to there reports from others who have observed a shadow cast by Jupiter or Venus. I know it has been done in the past, are present-day observers able to discern this? It's probably more a test of the observer's skies and eyes than any other factor. A few helpful hints are: cast it upon white paper, wait until you are dark-adapted, begin by using averted vision, and hold the paper close to your eyes with your hand a couple of feet away. Incidentally, if you place your had only a few inches form the screen, you will see the ill-defined shadow from the man made light pollution, skyglow and combined starlight.

So with Venus low but bright in the evening sky, and Jupiter now at magnitude -2.8 high in the midnight sky, give it a try. Let me know what you see. Don Machholz (408) 448-7077

COMET COMMENTS
BY: DON MACHHOLZ



One faint returning comet has been recovered lately. Meanwhile, Comet Wilson is still in our evening sky while Halley's Comet reappears in our morning sky.

Periodic Comet Grigg-Skjellerup (1986m): The periodic comet with the second shortest orbital period (5.15 years) was recovered on Aug 12 by K. Birkle with the 140" telescope in Spain. At that time it was mag. 22 and in Northern Orion. The comet will be closest the sun next June when it should brighten to mag. 12.

Comet Wilson (1986L)

DATE	R.A. (1950)	DEC	ELONG	MAG.	NOTES
10-22	20h 04.5m	+03° 00'	96°	11.0	This object seems to be getting a
10-27	20h 00.4m	+01° 24'	90°	10.9	slow start, so I've again re-adjust-
11-01	19h 57.1m	-00° 07'	84°	10.9	ed the magnitude estimates. I've
11-06	19h 54.5m	-01° 33'	78°	10.8	noticed less than a 0.5 mag. change
11-11	19h 52.5m	-02° 53'	73°	10.8	since I first saw it Aug. 8. Comet
11-16	19h 51.1m	-04° 08'	67°	10.7	Wilson is also quite small, under 2'
11-21	19h 50.3m	-05° 19'	62°	10.7	in size. At mid-month it is 255
11-26	19h 50.0m	-06° 25'	57°	10.6	million miles from the earth and 235
12-01	19h 50.1m	-07° 27'	51°	10.5	million miles from the sun, moving
12-06	19h 50.7m	-08° 25'	46°	10.4	at 16 miles per second.

WHAT GOES AROUND COMES AROUND -- HALLEY'S COMET

This month and next month we'll look ahead to the next two apparitions of Comet Halley. The orbit has been determined well enough so that we know exactly where the comet will be fore at least the next 150 years. Now let's examine the visit of Halley's in the year 2061.

The comet should be recovered by the year 2055, although there is some chance that we can keep it under continuous observation from new on. In the middle of the year 2060, large telescopes will observe it at mag. 16. By year's end it should be mag. 13 and up all night long. In late March, 2061, we'll lose it in evening twilight sky as the comet crosses Mars' orbit moving toward the sun. It will be about mag. 9 at that time.

By early June, 2061 it should be visible in the morning northern sky at the about mag. 6, perhaps a naked eye object. Moving towards its closest approach to the sun on July 28, Halley's travels north and between the Sun and us. That means that when closest the Sun, Halley's Comet will visible in the northern morning and evening skies, north of the Sun. Its closest distance to the earth will occur in late July, at 44 million miles, slightly further than the 39 million miles of the 1986 visit. During the next few weeks the comet will drift into the evening sky only, at about first magnitude. By October it will be lost in the Sun's glare, only to reappear in late Nov. 2061 in the morning sky as a binocular object.

Unlike Halley's 1985/6 visit, in 2061 the comet will favor the northern hemisphere and the summer months. It will be visible when closest the Sun and should display a long tail, but not always against a dark sky. You don't have to wait that long to observe Halley's Comet though, it is visible this month in the morning sky as it finishes up its 1985/6 visit. You will need a large telescope to see it.

Periodic Comet Halley (1982i)

Date	RA (1950)	Dec	El.	Mag.	HC+40° AT		HC+30° AT		EARTH (DIS)	SUN
10-27	11h 35.7m	-12° 18'	36°	12.3	0459	0552	0446	0549	429.3	358.3
11-01	11h 37.1m	-12° 42'	40°	12.3	0342	0457	0329	0452	429.2	363.3
11-06	11h 38.3m	-13° 06'	44°	12.4	0325	0502	0311	0456	428.5	368.2
11-11	11h 39.2m	-13° 29'	49°	12.4	0308	0507	0253	0459	427.3	373.1
11-16	11h 39.8m	-13° 51'	53°	12.4	0250	0512	0235	0503	425.7	378.0
11-21	11h 40.2m	-14° 14'	58°	12.5	0232	0517	0217	0506	423.6	382.8
11-26	11h 40.2m	-14° 35'	63°	12.5	0214	0521	0158	0510	421.1	387.6
12-01	11h 39.9m	-14° 54'	67°	12.5	0155	0526	0139	0513	418.3	392.4
12-06	11h 39.2m	-15° 13'	72°	12.6	0136	0530	0119	0517	415.2	397.1

Here are positions, elongations and magnitude estimates for Comet Halley. For year 2000 coordinated, add 1.8 minutes R. A. and then add 12 arc-minutes to the Dec., making it further east and south. Also given is the comet rise time (HC) and the morning astronomical twilight time (AT) for standard longitudes (75°, 90°, 105° and 120° W.) for two latitudes. Subtract four minutes for each degree west. Finally, I list the distance in millions of miles from the comet to the Earth and from the comet to the Sun. (Time to get the CCT out -- ed.)

SPACE PROGRAM UPDATE
BY: BOB FINGERHUT

REPLACEMENT SHUTTLE ORBITER AUTHORIZED

President Reagan has directed the construction of a replacement orbiter for Challenger. IT will de delivered in late 1991 or 1992. Other elements of the President's "Space Launch Recovery Strategy" include phase out of shuttle launching of communication satellites and compatibility of critical satellites with expendable boosters as well as the shuttle

SPACE SHUTTLE SOLID ROCKET BOOSTER REDESIGN

NASA and Morton Thiokol have identified a new design for the booster joint. The modified joint will have three, instead of two O-ring seals made of more resilient material and a heating device to keep the O-rings from freezing. The joint will have a capture latch to prevent or reduce rotation or movement in the joint. Extensive testing in planned.

SHUTTLE/CENTAUR REPLACEMENT FOR PLANETARY SPACECRAFT

NASA has recommended using Shuttle/Inertial Upper Stage (IUS) for launching the Galileo, Ulysses, and Magellan spacecrafts. Galileo would be launched in Nov. 1989 and arrive at Jupiter in 1995 after flying around Venus and using two Earth-gravity assists. Ulysses could be launched in late 1989 or late 1990 and would arrive in the solar polar region in 1994-95 or 1995-96. Magellan would be launched to Venus in April 1989 using a complicated trajectory involving one revolution around the Sun and would arrive in July 1990.

COMMERCIALIZED TITAN SIGNS FIRST CUSTOMER

Federal Express has signed an agreement with Martin Marietta for launch of an Expresstar communications satellite on a Titan III in 1989.

SPACELAB FLIGHTS CUT BACK

NASA will cancel 15-18 Spacelab shuttle flights planned for the next 5 years. They will include a large number of microgravity laboratory flights and a smaller number of life science missions. The cancellations are a result of the Challenger accident.

SPACE STATION BEING REDESIGNED

The initial space station opertional configuration is being scaled back. The much smaller facility will be more easily built with limited shuttle launch capacity and less emphasis on extravehicular assembly. This design could still evolve into the dual-keel design at a latter date.

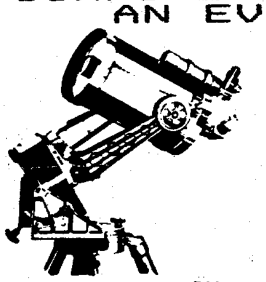
SOVIET MIR COMPLETES FIRST MISSION

The first manned mission to the Soviet Mir space station was completed with the two cosmonants returned to Earth on 16 July after 125 days in space. The Soviets now have two operational space stations in orbit.

FIRST TRANSFER ORBIT UPPER STAGE (TOS) ROLLED OUT

Orbital Sciences Corp. rolled out its first TOS in August. The commercially funded stage is being built and tested for launch of the NASA Mars Observer spacecraft from the space shuttle.

COMPUTER CONTROLLED TELESCOPE (CCT) AN EVALUATION BY: JOHN GLEASON



From the first instant I pressed the slew button, I knew that this was going to be a very special evening. A glowing red digital display flashed a complete description of the celestial object that I was interested in. Object coordinates, object type, magnitude, angular size, and visual quality were all before my eyes. I pressed the ENTER button. Almost effortlessly, the Celestron 11 telescope moved from a point high in Cygnus, down across the sky and over to NGC 7009. The Saturn Planetary Nebula in Aquarius was centered in the 75X eyepiece field in just 10 seconds. "How about NGC 6888" someone asked. In another 10 seconds the faint supernova remnant was just on the threshold of visibility in the center of the eyepiece. The group of amateur astronomers that had gathered around the telescope just shook their heads in amazement. On this particularly beautiful October night I had been given access to an important new telescope accessory. For myself it was the beginning of a new age of observational astronomy.

Making its debut at the 1986 Riverside Telescope Makers Conference at Big Bear lake, the Computer Controlled Telescope (A contest is currently under way to find a new name) was introduced as three Schmidt Cassegrain telescopes operating under the control of a small mini computer called the COMPUTER CONTROL SYSTEM (CCS).

Invented by computer programmer and telescope maker Mike Simmons (Mr. Simmons is famous for his design of the Simak optical system, and is the creator of the impressive Astromak telescope. See ASTRONOMY, April 1986), the CCS mates the power of the computer to today's modern production telescopes. The entire concept of the CCT is to literally save the amateur astronomer hours of observing time by locating and pointing the telescope automatically at pre-selected astronomical objects. Now more time can be spent observing, rather than searching for unfamiliar subjects. If you travel long distances to a dark sky site like I do, you know just how valuable your observing time can be.

The Computer Control System is composed of four basic elements. The POWER DEVICES SYSTEM (PDS) which contains all of the heat generating components. The COMPUTER DISPLAY SYSTEM (CDS), a small plastic 8" x 10" enclosure that contains the PC cards along with the keypads and display electronics. Two powerful stepper motors for the RA and DEC axis of the telescope are mated with two worm gear sets for each axis. Finally, as options, there are several accessories which include a two-axis proportional joystick and a 12V/18A power supply which converts household AC power to 12 VDC.

The heart of the CCS is a mini computer that has three built in catalogues containing more than 8000 astronomical objects. 7800 CNGC (Computerized New General Catalog of Non-Stellar Astronomical Objects) objects correspond to RNGC

(Revised New General Catalog) objects. All of the Messier catalog objects are listed along with 100 of the skies brightest stars used for alignment reference. In addition there is a listing of 100 double and multiple stars.

CCS information is displayed in the form of numeric digits and various backlit messages. Here you will be overwhelmed by the amount of information being presented to you on such a small display. Here is just a sampling of displayed information.

* Right Ascension and Declination coordinates are displayed by 7-segment LEDs. Simply put, these are easy to read digital setting circles.

* The Object Catalog Display prompted me to choose between Messier objects, CNGC objects or Reference objects. These were easily called up by entering the NGC or M number on the keypads.

* The Object Information Display showed the type of object that was called up. This is an extensive classification from globular cluster in another galaxy (GLOB GAL) to a dark nebula in front of a diffuse nebula (DARK). Thirteen classifications in all. Object magnitude is displayed in a range from -5.4 to 19.9. Object size is displayed in a range of .1 arc-minute to 5.9 degrees. All of this information appeared in tiny backlit characters that were somewhat difficult to read due to their size.

* The Object Quality Display indicated the estimated quality of the object that we were looking at. There are eight quality ratings. These range from ?/0 (can't compute, unknown information) to 7 (Superb). The quality of the observation was originally determined by Mike Simmons with a Celestron 14 at a dark sky site.

* The Status Display highlighted items about the status of the telescope and the CCS. This included the speed settings for the motion controls and joystick. You can choose between 4 speed settings (SLEW, SET, GUIDE, AUTO). SLEW, powers the telescope up to an impressive slew speed of 15 deg/sec. There is a 1 second beep as a warning before the telescope moves. Stand back when this thing takes off! SET, moves the telescope in a more conservative 15 arc-min/sec. This is great for positioning an object for photographic composition during astrophotography. GUIDE, is set at 15 arc-sec/sec max. This rate is for the astrophotographer. AUTO, is the same rate as GUIDE. It is to be used with the Automatic Guider which is to be a future optional accessory. All of these rates can be activated by directly using the display keypad or the remote joystick.

Four motion control buttons are positioned in a diamond in the upper right hand corner of the display. At first I wondered why the motion buttons were positioned in such a spot. In operation however, these buttons were in easy thumb reach if you hand held the entire display. North , South, East, and West telescope directions were indicated as the buttons were depressed.

The CCS has been extensively programmed to perform dozens of functions. These functions are activated by using one of 16 basic commands. Each of these commands is accessed by two horizontal rows of 8 soft keys. Each soft key has four associated displays, representing the function you wish to perform. Only the functional indicators for each soft key were illuminated during the command sequence. This was to help guide us through the correct sequence of commands.

During operation I quickly discovered that the function commands were where the real powers of the CCT became apparent. This is not just a fancy digital setting circle, but a true pointing and acquisition system.

Here is a review of just a few of the functions that were performed with the CCT, along with the associated commands.

Polar Alignment -- Alignment began the same as it did for any fork mounted telescope. So that the CCS could know where in the world it was, the the local longitude and latitude, the date, and the current Greenwitch Mean Time were entered. By pressing the BEGIN command, the telescope moved to the position of Polaris. Here the latitude wedge was only adjusted to place Polaris in the center of the eyepiece field. By again pressing the ENTER key, the telescope automatically moved to a reference star nearest the local meridian. What followed was a classic way of polar aligning our telescope to a high declination star and a low declination star. The reference star was centered in the eyepiece by using the motion controls of the CCS. By pressing the ALIGN key, the telescope returned to Polaris. Polaris was moved again to the center of the eyepiece field by adjusting the latitude wedge. By pressing the ENTER key once again, the telescope returned to the reference star. It was close to being centered in the eyepiece this time around. I wanted a better alignment so the previous steps were repeated two more times. The entire alignment procedure took less than 10 minutes.

Was this alignment good enough for high magnification guiding? A 3-times Barlow and an 8mm eyepiece were used in conjunction with a projection reticle.

During 15 minutes of guiding there was no perceptible declination drift. There was, however, a visible step movement in the guide star at the magnification of 1000X. This step movement is not significant enough to be a problem for deep sky astrophotographers.

SCAN Command -- Using this command, I was actually able to set the observational parameters of the CCS. Once set, the CCT would begin to search for these objects based upon the criteria choosen. The telescope would automatically move to each object and pause for a selected period of time.

As an example, I set parameters to observe only galaxies that were brighter than 10th magnitude, rated good or better, and higher than 70 degrees above the horizon. In addition I set a pause of 10 seconds for each object. By pressing the BEGIN key, the telescope would move off to what I suspect was the nearest object in the catalog meeting the set criteria. It paused for 10 seconds, beeped and slewed again to the next galaxy. At the same time the CCS display was providing information about angular size, magnitude, etc.

If you don't want the CCS taking control of your telescope, you can enter the RA and DEC coordinates of your choice by using the SET command. Comet hunter Don Machholz had provided me with the coordinates of the recently discovered Comet Wilson. The RA and DEC coordinates were entered and the telescope moved off to a location high in the southwestern sky. Once again in amazement, a very faint, fuzzy smudge of light that was the comet appeared centered in the eyepiece. With this kind of pointing accuracy an amateur astronomer could possibly break a few comet observing records by tracking down every periodic comet visible in the night sky in just a few minutes. One thing that I did not mention earlier was the fact that the CCS also corrects for precession and atmospheric refraction. This is another reason for the phenomenal pointing accuracy.

Speaking of comets, the CCT could become an important tool for comet hunters. A FIELD command identifies any object in the CNGC catalog that is within 30 arc-minutes of the center of the eyepiece field. This will be helpful to the comet hunter when trying to figure out what an object could be during a scan of the sky. The FIELD command will identify the object nearest the center of the eyepiece. You can move the telescope to the objects that the FIELD command is identifying. There is a short beep when a catalogued object is centered.

Besides using the CCT as a comet hunting tool, someone could begin a regular program of hunting supernova in galaxies by scanning through a pre-determined list of a hundred or more objects. If you had good photographs or drawings of the field stars around each galaxy, I am sure that eventually a new supernova would be discovered. If drawings or photographs are not available, here is another good project to get started on. Half the work is taken care of by the automated pointing of the telescope.

This amazing piece of equipment does have a few design flaws that were readily apparent during a continuous 6 hours of operation.

The POWER DEVICES SYSTEM was extremely noisy during operation. This was a little annoying throughout the night, especially at the quiet observing site. The noise is due to the "muffin" fan that was used to cool off components from the heat being generated. The power transistors encased in the metal enclosure dissipate about 200 Watts of power. You might say that this also means that the entire CCT package must be guzzling down power. You are correct. Estimated power consumption is 18 Amps. This is the primary reason for the optional 110 AC to 12 VDC converter so that you can have a continuous source of power by using household current. Unfortunately 110 AC at remote observing sites is difficult to obtain. With this in mind you will need a substantial battery reserve to power the CCT through a weekend of observation. My recommendation would be to at least use a 100 Amp/Hr deep cycle battery as your source of DC power for weekend use. This means additional cost (these batteries do not come cheap) but I would not recommend using your car's battery unless you can have someone help push-start your car the following morning!

I had mentioned earlier that the function displays were tiny. I often found myself moving closer to read the displays. Especially bad were the keypad numbers. These are much to small to read easily and they are probably the most important displays you need to see. From the keypad you directly enter the CNGC or M number of the object you want to observe. Again, I kept moving closer to read the numbers, often getting my face within a foot or so of the display to read them.

The accuracy of the CCT is so good, the optical and mechanical alignment of the telescope begins to play a major roll in how well the CCT points to an object. Celestron plans to "Accurize" each of its telescopes that is ordered as a CCT. This means machining the drive base and fork arms so that the the declination axis is perpendicular to the optical axis of the tube assembly. The right ascension axis must also be perpendicular to the declination axis of the fork mounting. If you are going to have your telescope retrofitted as a CCT, your best bet would be to send it back to the factory. Still, no matter how well aligned the mechanical components of the telescope were, there was still the problem with mirror shift during slewing. The mirror shift was indeed evident in the C11 as it went from a far west position to a far eastern position. This was the only remaining glitch in an otherwise precise pointing system. (None of the celestial objects were ever out of the 75X eyepiece field however.)

Finally there is the price. At the time of this evaluation the suggested list price was an estimated $3000. This includes the POWER DEVICES SYSTEM, COMPUTER DISPLAY SYSTEM, RA and DEC motors, and the associated hardware to mount these motors to your telescope. Yes, the telescope is extra. If you think that is a bit over-priced, remember that this is the suggested list price. Your telescope dealer can probably quote you a figure that is not so bankrupting. If you consider the cost of everything else in astronomy these days then the price of this unit fits in well along with those $300 wide-field eyepieces, $2000 solar filters, and $20,000 astrographic telescopes. Spending money on a hobby is simply a matter of personal choice and priority.

On the brighter side, owning one of these units will make you the center of attention at any star party. Everyone seemed to be fascinated by the movement of the telescope, the whir of the stepper motors, and the CCS display. In one 3 hour period we observed close to 200 objects. This was probably more objects than I have seen in the last 5 years, and most of these I had never seen before. In fact, seasoned veterans of observational astronomy were hard pressed to come up with NGC objects to look at. I kept hearing the same old numbers M 57, M 31, NGC 253.

The CCT could help you put together a fairly good observing show for first timers and beginners. How many times have you been frustrated at a star party, when you were struggling to find a deep sky object for a friend to look at. With the CCT you could begin by showing the planets and then move to several of the brightest single and multiple stars in the sky. Moving on, you could show the great open and globular star clusters. Continuing with your sky show, you could explain that stars are formed in dense regions of gas and dust called nebula. The CCT could quickly slew to these objects. Of course you would finish up by showing some of the brighter, more distinguishable galaxies. As a finale, have your guests pick out an object that they would like to see from a sky catalogue, then show them how easy it is to operate the CCT themselves. I can almost guarantee that they will be impressed over and over again. You may have just turned someone new onto astronomy!

In conclusion, I asked a number of amateur astronomers how they felt about the CCT. There was an overwhelming positive response toward the product by everyone who had a chance to work with it. When asked if they were going to run out and spend $3000 dollars for one, the reply was, "No John, we'll just use yours!" Regardless of the price, the CCT did what it was designed to do. Minor problems aside, this product really works and I would recommend it to anyone who takes their amateur astronomy seriously.

The purist would probably argue that the CCT takes away the sole of amateur astronomy. That amateurs will never learn the sky with such a device, will never experience the personal satisfaction of finding celestial objects on their own. In some ways I must agree. I do not believe that this particular device will help the beginning amateur astronomer understand astronomy any more than a pocket calculator will help you understand mathematics. The CCT is simply a tool whose time has come. It will only be as good as the individual using it.

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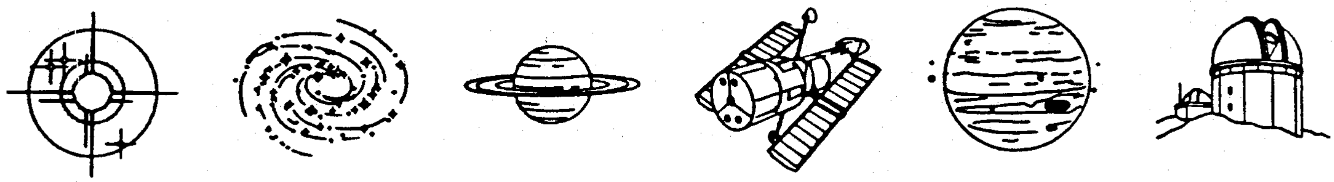

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Do you own a telescope? ________ If so, what kind?

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Is there any specific area of astronomy that you feel qualified to help others with? ______________________________

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