Intes 6-inch f/10 Maksutov Reviewed

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On Saturday, June 8, 1996, I stopped at Joe Sunseri's residence on my way to observe at Fremont Peak State Park, to pick up a Russian Intes 6-inch f/10 Maksutov optical tube assembly (OTA) for evaluation. Joe is a U.S. dealer for a lot of Russian optics. I have known him through the San Jose Astronomical Association for many years, and have bought such things as my "Baby Brandon" 63mm refractor from him.

I asked why he wanted to place a fancy telescope with me when I was not a likely sales prospect. After all, my unlamented 3.5-inch Questar left me sick of Maksutovs. He replied that he was hoping for publicity -- he liked my reviews of the "Baby Brandon", and felt that they fairly described both good and bad things about that instrument. He hoped I would review the Intes on the Internet.

Joe said the Intes units had a bad reputation in the US. He felt that was because some early units -- marketed through another dealer -- had problems that slipped through quality control, and because some Americans didn't think much of (ex-)Soviet technology. But the current approach to marketing was for someone in Europe to help the Russians on quality control, so bad units did not ship, and this process had produced a more mature product that ought to speak for itself.

That sounded reasonable. My doctoral thesis project flew on the Apollo that docked with a Soyuz in 1975, so I had learned a lot about what the Soviets could do at their technological best. I had been impressed, and since these high-end Russian optics stem from military technology, I was optimistic about the Intes telescopes.

Joe brought out the OTA, nicely packaged in a soft, foam-padded carry bag about ten inches square and two feet long. Unfortunately, the bag was black -- the wrong color for carrying optics in a car, exposed to the sun. Americans think black is high-tech because makers of cheesy-sleazy cameras find it cheaper to paint everything black than to make the outside a different color; black ought to indicate low quality, shabby workmanship, and mindless product design, even if it didn't sponge up solar heat. Of course, for lots of so-called high-tech products, black *does* indicate low quality, shabby workmanship, and mindless product design, so perhaps there is justice.

In any case, the Intes was matte white, a nice soft color that made it look bigger than it was. The unit was all-metal, with good fit and finish. It looked very solid -- if it had been a car, I would have

walked around it slamming doors and thumping on the hood. Flush heads of machine screws hinted at robust construction and ease of collimation, or of disassembly for maintenance. The corrector was coated. The secondary was not an aluminized spot on the meniscus, but a separate element, mounted at the center of the corrector. The extra radius and spacing add design freedom, making possible much better optics, particularly away from the center of the field, than in simpler designs. Of course, a separate secondary makes collimation more of a problem. The secondary obstruction was about one-third the primary diameter.

The OTA came with a medium-sized straight-through finder and a two-inch Crayford focuser: not focusing by moving the primary mirror was another plus, not only because that means no "mirror shift", but also because the correction for spherical aberration in a compound telescope is correct for only one position of the primary.

I took off the dust covers and peered up the optical path. The system was well baffled against stray light. It looked as if nearly the entire field of a two-inch eyepiece would be illuminated and free of vignetting.

I asked Joe about collimation. He asserted that collimation did not require return to the factory, that anyone with a double-pass autocollimator could do it. Based on inspection, I suspect that all relevant adjustments can be made from outside the instrument with simple tools, but all I know suggests that collimating a Maksutov is hard. Still, not having to return the instrument makes the problem bearable -- I do know a few folks locally whom I would trust to tackle the task.

Joe had another Intes on hand, a ten-inch f/10 of similar design, with a proportionately longer tube. This imposing instrument was painted in two tones of matte gray. It looked military and scary. If someone pointed it at me I would get nervous and step out of the way.

The six-inch OTA lists at $950. The ten costs $5990, and eight- and nine-inch both cost $3990. (They won't sell many eights if an extra inch is free.) Sizes to thirty-inch are available.

I repacked the instrument and headed for Fremont Peak. At my dinner stop, I covered the top of the black case with an opened magazine while my car sat in the sun. I arrived several hours before sunset, and left the instrument in the car -- now in the shade -- till nearly dusk.

Setup was fast, though complicated by mechanical problems not the fault of the instrument. I had my Super Polaris mount, and Joe had an adapter to fit between the Intes's mount points and a Super Polaris, but

(1) the adapter holes didn't quite match the spacing of holes on the Intes -- fortunately, the adapter was soft aluminum and the screws were steel, (2) the adapter center was far from the center of gravity of the telescope -- as mounted, the instrument was nose-heavy in declination, and (3) my one counterweight wouldn't quite balance the eight-pound tube assembly in right ascension. Happily, the imbalances were not too great for clutches, slow motions and siderial drive to cope with.

Ten minutes after setup, I found Arcturus in deep blue sky under modest magnification. The Intes had not reached thermal equilibrium. The temperature in my car had been ten or fifteen celsius warmer than ambient air temperature; I would say the telescope was ready to perform after an hour of equilibrating. The problem would be worse if it were stored indoors in a colder climate, or if its intended use were for quick setups to look at objects requiring high resolution.

Yet even that first look at Arcturus was a valuable test. The image was monochrome yellow -- there was no chromatic aberration.

Two problems emerged that were intrinsic to the Intes finder. Finders are always in the wrong place. All too often I found that in order to get my eye to the straight-through finder, I had to rotate the two-inch star diagonal out of the way, or crane my neck more than usual to keep from bumping the tube. I like straight-through finders, since you can open both eyes and use them as reflex devices. So if I had this unit, I think I would mount a finder on a longer stalk, farther from the rest of the telescope. Or I might want a zero-power unit, which can be used with the eye backed a considerable distance away from the tube. Furthermore, the finely-ruled finder reticle was invisible against the night sky. An illuminated finder would help, or I could disassemble the unit and make wider reticle lines with a magic marker.

The Crayford focuser had a different feel than rack and pinion and helical units. There was a friction adjustment -- a screw -- which was quite important: too loose, and the focuser moved under the weight of the eyepiece; too tight and it didn't move at all.

One nice feature of the tube assembly was a handle. It not only provides a grabbing place for fast slewing, but also prevents worries about whether I am really bracing the tube securely against the mount as I try to thread in screws with numb fingers in the dark.

My observing for the night was of two kinds -- low-magnification views of faint fuzzies and jam-on-the-power tests. At low power, the Intes was a delight. I started with 58x (26mm Plossl in 1.25-inch barrel), then dropped in a 32mm Erfle in a two-inch barrel for 47x.

Star images were sharp clear to the edge. The eye is good at focusing out field curvature, so I am not sure the field was flat, but for visual work, the Intes wide-field performance was excellent.

I went through sixty-three Messier objects and looked at Comet Hale-Bopp. The views were wonderful. Those who like Nagler eyepieces would enjoy them on this instrument. One doesn't think of Maksutovs as deep-sky telescopes, but that's because the ones we see are mostly slower than f/10. An f/10 telescope with a well-illuminated two-inch field and crisp star images to the edge is a fine deep-sky instrument. In this respect, the Intes six was a real winner.

My high-magnification work covered single stars, doubles, and Jupiter. I had a new eyepiece -- a 2.5 mm Vixen Lanthanum. (It worked fine, and yes, they do have 20 mm eye relief.) It gave 600x with the Intes -- one hundred per inch -- which is rather too much for any sane purpose, and surely enough for critical optical testing. (I did not say that optical workers are insane. Truly, I did not.)

Seeing at 600x wasn't quite perfect. I couldn't star test in the style of H. R. Suiter. At 600x, single stars showed a diffraction pattern with rings continuously visible, but not steady. Images looked the same inside and outside of focus, yet the motion hid the fine details that Suiter's tests require.

(Saying "seeing at 600x wasn't quite perfect" is like saying "well, a hundred million dollars is all right, but it would be nice to have a little more money". It was a very fine night.)

At 600x, double stars were easy. Epsilon Bootis was wide open, and there was lots of dark space between the components of zeta Bootis -- its 0.9 second separation is twenty-five percent greater than Dawes's limit for a six-inch. Gamma Virginis, a wider pair, was particularly nice -- one could study the diffraction patterns of the two stars separately, and also get a sense that the telescope was doing a good job separating a moderately close double. All these stars would have separated at lower magnification, but I didn't try -- I was having fun with the new eyepiece. (Just remember, you're not allowed to use a hundred diameters per inch until you have logged a thousand objects at exit pupil of four millimeters or greater. Neener, neener, neener.)

Jupiter was frustrating, way south, and rising late. I took a look when it was low enough to show lateral color from differential atmospheric refraction -- the top edge was blue and the bottom red. There were hints of more detail, and the symmetry of the Galilean satellites was fun -- they looked like this:

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Later, with Jupiter further up, things improved. I tried 375x and 300x, and decided that 214x was the right magnification. Seeing was still not perfect, but there were many belts visible, and one or two seemed double. The telescope was doing well. Furthermore, the images of the Galilean satellites differed from the images of stars -- I wouldn't quite call them resolved, but they were obviously not point sources.

Joe hand-picked this instrument from stock on the basis of optical quality. I have no way to know whether they are all as good, but this one was very fine. An instrument with a one-third-diameter central obstruction gives up considerable optical performance thereby, inescapably, due to the wave nature of light. Yet as far as I could tell, this particular Intes 6-inch f/10 Maksutov gave up very little else, which made it a quite good instrument indeed.

So, who should consider buying one? What's the competition?

Maksutov fans sometimes call them "refractor like". Nonsense. The central obstruction makes a difference that a skilled observer can quickly detect, given good seeing and the right object. These instruments cannot compete against refractors of similar aperture and quality; besides, the buyer of a six-inch refractor will end up with an instrument several times bulkier and heavier, that costs several times as much. The matter is too complex for easy generalization, but it is perhaps fair to say that on low-contrast extended detail, a good six-inch with one-third-diameter obstruction performs like an equally good four-inch unobstructed telescope.

How about other compound telescopes? That depends on what you believe about quality and quality control in the Schmidt-Cassegrain telescope (SCT) market. A good f/10 SCT, with a one-third-diameter central obstruction, will have on-axis performance identical to an equally well-made Maksutov of the same aperture and the Intes design. SCTs tend to be cheaper than Maksutovs, especially at large size, but what Celestron and Meade have produced in the past has not been that good on the average, and may not be that good today. How lucky do you feel, and how loudly are you willing to complain if you get a lemon? One manufacturer -- Takahashi -- did produce a high-quality SCT, but it was not cheap! Furthermore, the usual commercial SCT designs do not give sharp images over a two-inch field, even a curved one, and I do not believe that smaller SCTs fully illuminate such a large field anyhow.

One competitor is a fast Newtonian. Again there is a quality issue

-- we aren't used to fine small paraboloids -- but a good six-inch f/5 Newtonian, with a coma corrector, would have performance comparable to the Intes Maksutov, even over a wide field. Such an instrument would likely end up with a central obstruction a tad smaller than one-third diameter. With good design, the widths of its secondary support vanes could be made negligible. For visual use, low-magnification eyepieces would be 20 or 25 mm focal length, so that a 1.25-inch focuser -- and a smaller diagonal -- could be used. The instrument would be bulkier than the Mak, but not much, since the mounting size would likely dominate. My 2.5 mm eyepiece would only give 300 diameters magnification, but that's plenty. And the whole thing might be cheaper than a Maksutov.

In summary, the Intes 6-inch f/10 Maksutov optical tube assembly was well-made optically and mechanically. It offered performance on extended low-contrast detail comparable to a well-made four-inch refractor, free of chromatic aberration, with the light grasp and performance on close doubles of its full six inch aperture. Star images were excellent across a well-illuminated two-inch field. The $950 price was steeper than commercial Newtonians and Schmidt-Cassegrains of comparable aperture, yet these latter units were not generally of comparable optical quality. Apochromatic refractors -- even four-inch ones -- tend to cost a good deal more than $950. Thus the high optical and mechanical quality of an instrument as compact and inexpensive as the Intes six-inch Maksutov ought to ensure it a steady market among amateur astronomers in the United States.

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I have just put in an all-nighter weird even by the standards of sci.astro, much less sci.astro.amateur. Late Saturday afternoon, July 6, I drove to Fremont Peak State Park for a night's observing. High cirrus clouds blocked much of the sky from the San Francisco Bay area, but the distant west was solid blue, so I was optimistic.

Others were not. There was only one telescope besides mine in Coulter Camp, in an area that often has fifty on a good night. I found the hard-core observers in the flat area behind Ranger Rick's house, not far from the 30-inch building, and set up there.

I had new equipment to show off and try out. I ended up buying the Intes six-inch f/10 Maksutov optical tube assembly that I reviewed in sci.astro.amateur in early June, 1996. Everyone was quite curious about it. The Intes is built in post-evil-empire Russia, by a company that used to make optics for Soviet military use. I had been impressed with the optics of this specific unit, and when I finally decided I needed yet another telescope, I was glad to find that Joe

Sunseri had not sold the one I tested. It came with some documentation that I overlooked in my original report, a nice certificate from the folks in western Europe who do quality control on these things before they ship to the US, stating that the wavefront error was 0.123 wave peak-to-valley on the wavefront, 0.024 wave root-mean-square, and that the Strehl ratio was 0.983, and adding incidentally that the warranty for optics and mechanics was for ten years from date of selling. Those performance numbers are startlingly good, and my first cynical reaction had been to wonder whether maybe somebody just made them up, but the Mak had performed well in the field, so maybe not.

Setup was fast; I had made an adapter plate so the Intes would fit conveniently on my Super Polaris mount, and had gotten a heavier counterweight. The Super Polaris is jigglier than with my 90 mm fluorite, but within bounds for visual work.

Clouds began to clear as the sun went down. By the time I had identified the field for my first target, a small planetary in Lupus, the last wisps of cirrus had blown away. I identified the planetary by blinking with an Orion Ultrablock filter, using both 47x and 167x. The Intes is a particularly fine deep-sky instrument, for its fully illuminated field spans most of the width of its two-inch focuser, and the optical design produces round, sharp star images simultaneously in focus across that entire width.

Subsequently I switched to double stars. I showed some of the crew a 1.1-arc-second Struve double that nobody had heard of, that impressed me, but Rich Neuschaefer wanted to look at nu Scorpii, an advanced version of the double-double in Lyra. The close pair has slightly less than an arc-second of separation and more than two magnitudes of brightness difference (_Sky_Catalogue_2000.0_ gives 0.9 seconds and 2.5 magnitudes), but the Intes split it cleanly at 167 diameters, and a view at 300 x showed dark space between the two stars. Rich said he thought it was giving a cleaner split than his 155 mm f/9 Astrophysics ED triplet, which is high praise, but theoretically possible, since the central obstruction of the Mak slightly reduces the radius to the first minimum of the stellar diffraction pattern. (I certainly would not expect the Mak to equal the refractor in observations of low-contrast detail, though; the same obstruction throws extra light into the rings.) But for the Intes to achieve the theoretical potential means that its optics are well-crafted indeed.

I ran through some more doubles, then looked for another planetary or two, and while I had the Ultrablock threaded in, I thought to take

a look at the Veil Nebula. At 47x there was a lot of detail in both the eastern and western arms, and at least one patch of the tenuous glowing matter inside the perimeter of the supernova remnant was also detectable.

I always run a Messier survey when I have a new telescope. I had gone through more than 60 in early June. I tried a few more. M15 was partially resolved at 167 diameters. At 47x, M31 spanned more than three field widths of my 32 mm Erfle; even though the galaxy was low in the northeastern sky, it was over four degrees long. I could detect at least one dark lane, in close to the nucleus.

So at the moment, I am well pleased with the Intes 6-inch f/10 Maksutov. Yet one thing makes me nervous: If the Soviets made all their military equipment this well, how fortunate that the cold war ended peacefully.

I put my equipment away at moonrise, stayed around and chatted for a while, then headed back to the Bay Area. I stopped for a meal at a Lyons restaurant on the way, and suffered the usual soul-searching agony of the indecisive late-nighter -- dinner or breakfast? I won't tell you what I had or whether I ate it.

As dawn began to gray the east, I turned into the parking lot for Palo Alto Baylands, a nature preserve built on what remains of the marshy shores of the community. A trail of low cloud wended down the bay, parallel to the shore and a little out over the water, and more cloud topped the ridges of the peninsula hills, but most of the sky was clear. I got a last glimpse of Polaris in brightening sky, checked my watch, and faced northwest.

At 0514 PDT a pinkish orange dot appeared in the far distance and brightened rapidly, a bit teardrop shaped, like a horizontal candle flame, colored like low-pressure sodium vapor lamps, trailing a thin, evanescent linear wisp of something like smoke. I had my 63 mm Brandon refractor on the pan-head tripod, tension adjusted, 20 mm Erfle eyepiece in place. At 18 x, I could track Space Shuttle Columbia continuously, as it streaked across the intensifying blue, far faster than any satellite, back from beyond the sky, heading home to Kennedy Space Center, the width of the continent away. I waited more than ten minutes subsequently but heard nothing that I recognized as a sonic boom.

I had seen _Independence_Day_ two days earlier, and for all that it was exhilarating to watch alien invaders get blasted out of the sky, the reality of a space ship landing on the Earth is prettier and

more impressive than any special effect. Besides, this one is ours. And who knows, maybe the aliens build great Maksutovs, too.

    My night was over, but my all-nighter was not; tickets were to go on sale at 10 AM for a local show of _Dead_Can_Dance_, a musical group I enjoy, and I had to go and stand in line at Tower Records if I wanted any. I ended up with good seats, but as I stood in the queue and looked up at the last-quarter moon beginning to sink down from the zenith, I could not help but think that there is a show every night, we all have front row seats, and what's more, we're part of it.

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    I had my Intes six-inch f/10 Maksutov at Fremont Peak State Park, near San Juan Bautista, California, on the night of July 19-20, 1996. With moonset at an early 10:30 PM, I would have expected more people to show up, but there were only about five telescopes there.
    I continue to be very impressed with the versatility of the Intes. Setup and alignment are quick (which has more to do with the Super Polaris mounting than with the Intes OTA). The whole thing fits into my Geo Metro and leaves room for a passenger. The well-illuminated and well-corrected two-inch field makes possible the use of wide-angle long focal-length two-inch-barrel eyepieces for very satisfactory low-magnification views, whereas f/10 allows considerably more magnification with no difficulty.
    The low-power eyepieces that I have been using are an old standby, -- a University Optics 32 mm Erfle, and a new 40 mm Koenig type II, a military surplus unit (Vietnam War -- I didn't think to ask which side) that I bought off AstroMart a few weeks ago. They give 47 and 38 diameters, respectively. I also have a 55 mm Plossl -- University's again -- but have not thought to try it on the Intes yet. These units are all in two-inch barrels. Mostly I use the 32 mm; the 40 mm is so heavy that it is fussy to adjust the focuser clutch to hold it without slipping.
    Anyhow, at 47x, 38x and 150x (10 mm Vixen Lanthanum), comet Hale-Bopp showed central concentration even greater than last week; the nucleus was almost stellar in appearance. The coma was strongly asymmetric. I wouldn't yet call what I saw a tail, though that may be more a judgement call on the use of the word than anything else. I did not think to try looking for the comet naked-eye again.
    At 47x, I could trace out M31 to more than four degrees long, and see clearly one dark lane on one side of the nucleus, bounded on both sides by the glow of the galaxy itself. At the same magnification, I could see color in the Trifid Nebula and a great deal of dark detail in the Lagoon Nebula.
    I chased after a batch of double stars, using mostly the 10 mm

Lanthanum for 150x, but switching occasionally to a 4 mm Meade Research-Grade Orthoscopic for 375x, for toughies. Two were worthy of note.

_Sky_Catalog_2000.0_ (volume 2) gives a separation of 0.6 arc second for Struve 2215 (ADS 10795), with magnitudes of 5.8 and 7.8. The most recent measurement of two was in 1959, the star seemed to have closed by a few tenths of an arc second in the preceding century. I found it elongated and perhaps constricted at 375x -- the elongation was not symmetric, the end where the fainter star was appeared pointy. This is extremely good performance, for Dawes's limit for a six inch is about 0.76 arc seconds.

Furthermore, the same source gives a separation of 0.7 arc seconds, which does not appear to be changing, for Otto Struve 338 (ADS 10850), whose magnitudes are 6.8 and 7.1, and I got a clean split on that one, also at 375x. That is also quite impressive performance.

In both cases, I did not look up the position angle beforehand, rather, I noted what it appeared to be while observing and cross-checked with a catalog for confirmation. Seeing was not the best for double-star work. It took several minutes of staring, in each case, to get a moment clear enough for a critical inspection of the star.

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On the night of July 20, 1996, I took my Intes six-inch f/10 Maksutov to a star party at Foothill Park, in Palo Alto, California. This park is about half way up the east side of the hills of the San Francisco Peninsula, about a fifteen minute drive from my house. The star party was well attended -- many telescopes up through big Dobsons and refractors, and lots of the general public looking through them. I believe the star party was organized by the Peninsula Astronomical Society, but I am not sure; I heard about it by word of mouth (well, word of Internet) at the last minute.

I arrived at dusk. Temperatures were comfortably in the shirt-sleeve range, having backed off from daytime highs pushing 100 F, but the Intes, which had been stored in my non-air-conditioned house, was slow to equilibrate; it took nearly two hours before it was ready to perform. That's one of the gotchas with Maksutovs.

The Moon was up. The terminator had just cleared Posidonius, and the great wrinkle ridge that runs down Mare Serenetatis at about Selenographic longitude 25 E was beautifully illuminated by grazing light.

Jupiter was popular, though the seeing to the southeast was still rather ratty. For variety, I showed some people M22, which was

obviously granular (starting to resolve) even at only 58x. Comet Hale-Bopp was also well-placed. I explained that the central condensation meant that stuff was evaporating from the nucleus and hinted that the comet would be very spectacular next spring. People seemed impressed that when Comet Halley (1986 apparition) was as far from the sun as Hale-Bopp is now, it was ten thousand times fainter.

Bored with Jupiter, I chased down Uranus and Neptune, using the finder charts in the _Observer's_Handbook_ of the Royal Astronomical Society of Canada. They were close together near the Capricornus / Sagittarius border. Both showed featureless discs at 150x, Uranus greenish and Neptune blue. I did not notice any moons, but did not particularly look for them. One passerby was not certain she could tell that Neptune was a disc at 150x, so I put in a 4 mm Orthoscopic for 375x. The disc became obvious to her then, but she commented that it was not steady -- she was noticing seeing effects. I switched back to Jupiter with the same power, to show just how bad things actually looked with too much magnification. Then I put back in the 10 mm eyepiece for 150x, and showed a much more satisfying view. I was glad I had looked at Jupiter again, for one moon -- Io, I think -- was very close to the eastern limb of the planet, almost touching it.

My eyepiece for 150x was a 10 mm Vixen Lanthanum. These are great star-party eyepieces. The 20 mm eye relief means I can focus with my glasses on, tell spectators to leave theirs in place, and no one has to refocus. With so-so seeing, it is difficult and time-consuming to get the focus right, so the long eye relief is an important feature.

After both telescope and seeing had settled down a little, I split Antares with the Intes at a magnification of 375. Less might have done. This experience illustrated one of the differences between a Maksutov and a refractor of similar aperture and quality. Rich Neuschaefer was set up ten meters from me with his six-inch f/9 Astrophysics. I asked him to take a look at Antares, too, for I had not brought any catalog that showed the position angle of the secondary, and couldn't remember it from the last time, and wanted verification. Rich had a much cleaner separation than I did, for at least two reasons.

First, at the time I looked, the Mak still hadn't settled into thermal equilibrium. Rich had set up well before I did, and refractors are generally vastly less temperature-sensitive than Maksutovs. His telescope was performing more nearly at its actual maximum capability than mine.

Second, the two-inch secondary of the Mak roughly doubles the proportion of light that goes in the rings of the Airy disc compared to an unobstructed system, from perhaps fifteen percent to a bit over

thirty percent. A lot of that light goes into the outer rings, where it reduces contrast in lunar and planetary views. With a star as bright as Antares, the difference in the Airy disc is obvious at the eyepiece. The companion of Antares is five magnitudes fainter than the primary, and I was seeing it against a much brighter background than Rich was. What's more, that background was in motion; the seeing was not steady, and all those extra rings were dancing and jiggling, all but swamping the companion. No doubt the rings were dancing in Rich's telescope, too, but they were too faint to see. It would have been much easier for the Intes to resolve Antares in better seeing, whereas the big refractor was less bothered by imperfect conditions.

I have said before that even with superb optics (which my Intes and Rich's Astrophysics both seem to have), it is nonsense to think that the images produced by a system with a large secondary can truly be refractor-like, compared to a refractor of equal aperture. The difference I just described is one of the things I had in mind, that will be immediately obvious to an experienced observer.

Incidentally, splitting Antares in a six-inch is nothing to boast about. As reported in Burnham's _Celestial_Handbook_, it has been done in a three-inch. I myself have resolved it in my 90 mm refractor (Vixen fluorite) at only 116x. The usual decline of seeing with distance away from the zenith makes it a challenging task in mid northern latitudes, though. My 90 mm observation was from my back yard in Palo Alto, in late summer.

Later on I looked at epsilon Bootis and 70 Ophiuchi. Both resolved clearly at 150x. The telescope had come to equilibrium, and these stars were higher in the sky than Antares, so the Intes delivered sterling images.

I also looked at a few more deep-sky objects. The small globular clusters NGC 6522 and 6528 lie just west of the spout of the teapot. It was easy to get both in the same 58x field. M13 showed resolution and lanes of stars at 150x, and at that power and at 58x I showed people NGC 6207, the brighter of the "companion" galaxies to the globular.

There were several interesting instruments at this star party. One man had bought Intes six-inch optics from JMI and assembled them into an optical tube assembly of his own manufacture. The Intes units that JMI had were reportedly of spotty quality; it is interesting that the optics that this person had were excellent, once collimated. Perhaps the JMI units merely suffered from mechanical problems.

The woman set up next to me had some rather classic hardware, including a Cave six-inch Newtonian -- it looked like f/8 or f/9 -- and one of the relatively rare Coulter collapsible 4.25-inch

"back-packer" telescopes. Both seemed to work well.

By prearrangement with the park rangers, the star party terminated at midnight. A good time was had by all.

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I have had my Intes 6-inch f/10 Maksutov for five months now. I thought I would write up an extended-use report.

In a nutshell, there have been no unpleasant surprises, and I am still very pleased with the instrument. But truth is in the details, so...

The Intes 6-inch f/10 Maksutov offers optics of sparkling quality in a compact, inexpensive, easy to use package. Wavefront correction is excellent, and that means that although the instrument gives up some image sharpness because of its 1/3-diameter central obstruction, it gives up little else. Furthermore, the designers have used the extra degrees of freedom given by the separate secondary to provide round, sharp, star images clear across the 1.8-degree field of a long focal-length two-inch diameter eyepiece. The design is well baffled against stray light across the entire field, too, so the telescope's excellent high-power images are complimented by high-quality low-magnification views of wide deep-sky objects. In practical terms, that means that I can use the telescope at 600x to examine the subtle elongation of the Airy disc of gamma-two Andromeda, or to study detail in the belts of Jupiter at 250x, then turn around and get a dazzling two-degree view of the stars and nebulosity of the Pleiades at 27x, or detect at the same magnification the broad, subtle, variation in background sky contrast that reveals the presence of the Sculptor or Fornax Dwarf Galaxy. A telescope that can do all of these things well is versatile indeed.

I and several others have compared this instrument to similarly compact high-quality refractors like the 105 mm Astro-Physics Traveler or the 100 mm Tele Vue Genesis. The Intes is a clear competitor in this rather exclusive league: The 4-inch instruments of course lose on overall light grasp, lose on sharpness of high-contrast features (like close double stars of comparable brightness), and approximately keep up on low-contrast stuff like subtle planetary detail. What's more, the Intes is every bit as portable as even a stubby refractor like the Traveler, and at $950 (US) for the optical tube assembly, lists at a substantially lower price. Six-inch and larger refractors would out-perform the Intes across the board, but at vastly increased cost and with far less portability.

A high-quality six-inch Newtonian would probably perform about as well as the Intes on axis, and do it at lower cost, but would be much less portable. Any Newtonian used at wide field would suffer from substantial coma and astigmatism off axis, unless equipped with an expensive coma-corrector.

A well-made Schmidt-Cassegrain of comparable aperture would also perform as well on-axis as the Intes, but good Schmidt-Cassegrains are scarce. Also, the common commercial designs do not give particularly good images away from the center of the field.

I have been using the Intes on a Vixen German equatorial mounting, the one OEM'd for Celestron under the "Great Polaris" label. That is a good combination. Many other small mountings would do as well. At f/10, almost any eyepiece works fine, though we all have our favorites.

The down side of the instrument is minimal. As I anticipated when I bought it, the Intes -- like most Maksutovs -- takes a relatively long time to settle down and start performing when set up at a temperature different from that at which it was stored. Mine begins to work well after an hour or so, when going from room temperature to outdoor temperatures in the 40s or 50s. I work around the problem by putting the telescope in the back seat or hatchback storage area of my car for the ride to an observing site, with the case and some windows open. That works for distant sites, but this instrument will probably never be very useful for quick looks from my back yard at objects demanding high resolution.

The two-inch Crayford focuser is quirky at times. Focal travel is limited, though the range is well chosen. Few eyepieces focus without a star diagonal, but I routinely use one anyway. Some of my older eyepieces have mechanical stops (what keeps the eyepiece from falling through the focuser into the tube) at the eye lens rather than at the focal plane, and many of these require an extension tube to focus properly. Also, though the Crayford has an adjustable clutch, some of the big, heavy, modern eyepieces are too much for it -- it tends to creep when I am using them, unless I lock the clutch so tightly that I cannot focus at all

The big corrector way at the front of the tube tends to gather dew. The telescope did not come with a dew cap, but it was no problem to fabricate an effective one from sponge rubber and Velcro.

Finally, although the Intes design appears mechanically robust, I

do worry about collimation difficulties. Yet so far, no adjustments have been required.

So as I said above, the Intes 6-inch f/10 Maksutov is an inexpensive portable instrument of uncompromising optical quality. I commend it to you all.