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Addendum To Contract 

25X1A

Micro-Stereoscope And Binocular Microscope Combination

The purpose of this addendum is to suggest some possible alternate solutions to increase the resolving power, contrast, and secondary color in the present design.

There are three areas which we would consider investigating, and which would yield the most results in the shortest period with minimal cost.

The following outline describes the areas, time, and cost figures for each area. These figures are estimated with some degree of accuracy, however, they may vary in actual cost by a factor of  $\pm$  10%.

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**Declass Review by NIMA / DoD**

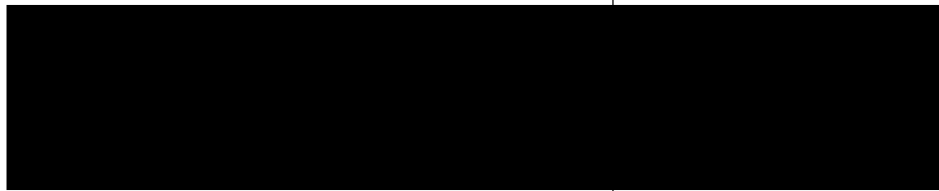
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## 1. Optimization of the zoom portion of the system.

As can be observed on the aberration plots, variations in coma, as a function of zoom positions, limits the off-axis resolving power.

By changing the design of the zooming portion, the full field high contrast resolving power at the 1X zoom position for all objectives could be improved by a factor of 2 times.

Cost for this portion would run:



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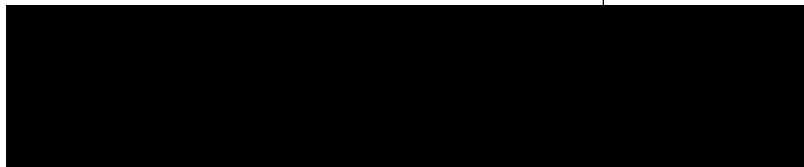
## 2. Eyepiece design.

Since existing 10X wide field eyepieces have been designed to function best under particular operating conditions, it is felt that the instrument could be closer to an optimum design, using specially designed eyepieces. The high contrast resolving power could have an expected increase of about 10 to 20 percent at the edge of the field while maintaining adequate eye relief for use with eyeglasses. In addition, since the exit pupil of the system is in a rigidly constant position, even while changing magnification, it would be desirable to maintain this constant position for all field points. This can be achieved by carefully correcting the spheric aberration of the pupil. While this correction does

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not add to the resolving power of the instrument, it does decrease operator fatigue over extended periods of use. Many eyepieces have kidney-shaped dark patches in the field and require movement of the head in order to see the total field, a condition which certainly must cause considerable eye fatigue to the user. The cost of designing a new 10X wide field eyepiece would be:



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The additional cost of manufacturing one set of eyepieces for the prototype would run approximately



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### 3. Reduction of secondary color.

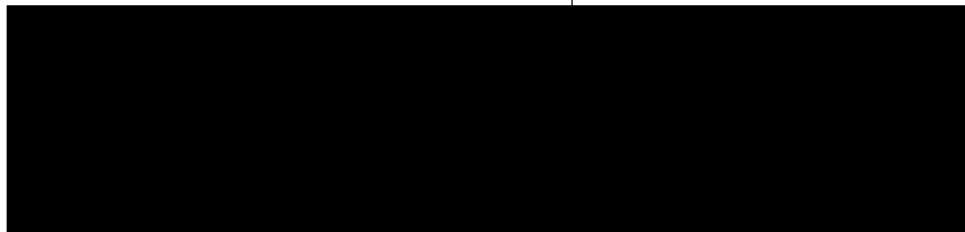
The limiting axial image defect of the system is secondary chromatic aberration. This results in a purplish imaging of black objects with a greenish yellow background haze. This chromatic condition could have considerable effect on the imaging of low contrast targets as can be witnessed by the use of color filters with an ordinary achromatic microscope. In a non-quantitative manner, the effect can also be seen as a background haze surrounding a bright spot and thus affecting fine structured low contrast objects. Although it is difficult to predict the change in MTF at higher frequencies of low contrast targets resulting from a 2X reduction in secondary color, an increase of approximately 10 percent might be expected.

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Reduction of secondary color is a rather tedious task requiring careful glass choice along with large amounts of computing. Considerable reduction could certainly be achieved by the use of a mineral flourite, but this material has a cost of approximately 20 times the average optical glass. Use of other materials, such as short flints and phosphate crowns, might increase the cost of glass by a factor of two and would not affect the total cost of the instrument by any great degree.

The change in design to reduce secondary color would have the following costs:



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