12 February 1965

Dear Robin:

I have looked into changing the anti-reflection coating to a standard coating with higher reflectance values and tilting the front glass. The coating manufacturer informed me that the standard magnesium fluoride coating will reflect about 3% instead of the ½% for the special HEA coating of the Optical Coating Laboratory. The representative from OCLI agreed that the standard coating will show less surface smudges than the HEA coating. This coating is being procured along with tilting the glass 7°.

The 7° tilt is based on what is practical with the present design, test results, and calculations. A short test was conducted by placing a 10x10 glass plate (uncoated) in front of a collimator. An observer was positioned in front of the plate at the same distance he would occupy in front of the viewer. With the glass untilted a person could not see himself in the glass plate while looking into the collimator at a target. Even glasses would not cause enough reflection to show up. A virtual image was possible by holding a mirror over one eye and reflecting the light back to the glass. By tilting the glass 7°, this image was moved to the upper edge of the 10x10 plate.

The tilted glass also helps to eliminate reflection from overhead lights behind the operator. With the glass tilted 7° the light could be as low as six feet and 12 feet behind the operator and still not be seen.

STATOTHR [redacted] has been given the formal okay to start work on Phase II, part 2. The completion date for this is 7 May 1965. I have also spent some time determining new specifications for them. The overlapping method complicates the specification when the gratings are tested as individual items without overlap. Would Dick look the enclosed specifications over and return them with any comments he may have. The attached sheet provides basic data on the subject.

The vacuum hose and pump sound fine. We will have a connector on the viewer with a serrated connection to accept your hose. When you return the specifications could you include the I.D. of the hose you will use.

I will be looking forward to seeing you around the first of May for the acceptance test, assuming you can send us a grating the latter part of April.

Sincerely,

[redacted]

Enclosures (2)

STATOTHR [redacted]

3.0 REQUIREMENTS (addendum)

3.1 The technical design goals of the 10x10 transmission grating replicas which are to be produced during the second try of Phase II shall be as follows:

3.1.1 Wavelength band to be used - 5086A. Test grating at 5000 - 5500A. For intensity data intergrate results from 5000 - 5500A°. Angular deviation measurements shall be measured at 5086A°.

3.1.2 The grating shall disperse a total of 27 orders consisting of the central order and 13 orders on each side of center to the required amounts as stated in Section 3.1.3. Any additional orders are acceptable, but they should not detract from the transmission values required.

3.1.3 The nominal angular deviation of the central ray in each exit pupil of the various orders shall be:

First order:	25'
Second order:	49'
Third order:	1° 13'
Fourth order:	1° 38'
Fifth order:	2° 2'
Sixth order:	2° 27'
Seventh order:	2° 51'
Eighth order:	3° 15'
Ninth order:	3° 40'
Tenth order:	4° 4'
Eleventh order:	4° 29'
Twelfth order:	4° 53'
Thirteenth order:	5° 18'

The tolerance for each of the above deviations shall be ±3 minutes.

3.1.4 Intensity Variation

When two crossed replicas are used, the light intensity variation over the exit pupil matrix field shall be no greater than 4:1. Due to the overlapping of the exit pupil orders the light intensity variation between discrete orders need not be the 4:1 ratio of the combined system. Due to the overlapping in both X and Y planes a complex arrangement exists.

When individual readings are made of the transmission in each order, the following formula converts any set of individual readings to the value obtained when the gratings are crossed and exit pupils are used at 50% overlap.

$$T_{ab} = \frac{2(T_a \times T_b) + (T_a)^2 + (T_b)^2}{4}$$

where T_{ab} is the transmission of 4 combined orders. Such as

Order:	Xaxis#	Yaxis#
Combinations:	4	4
	5	4
	4	5
	5	5

then $T_a = 4$

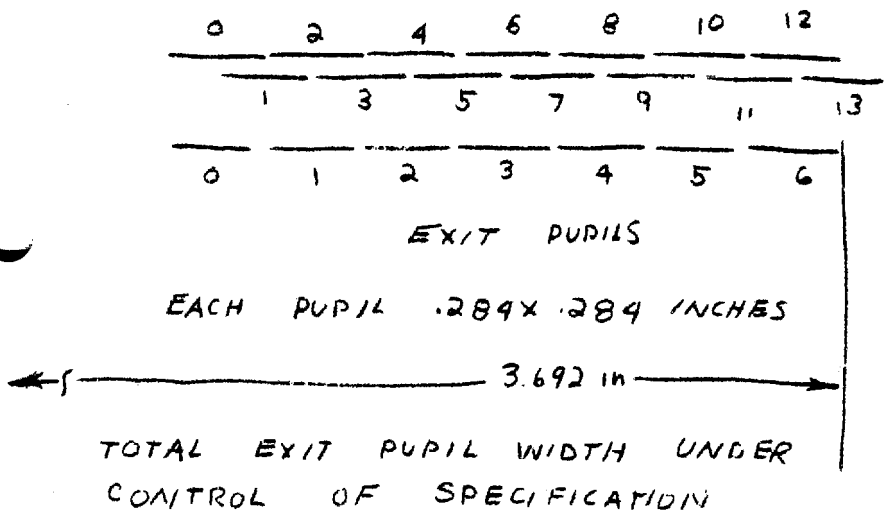
$T_b = 5$

3.1.5 Number of order combinations. With a ±13 order system there are 676 order combinations.

3.1.6 The minimum transmission in any of these 676 order combinations shall exceed .0225%. This corresponds to the 3% for a single order in the previous specification.

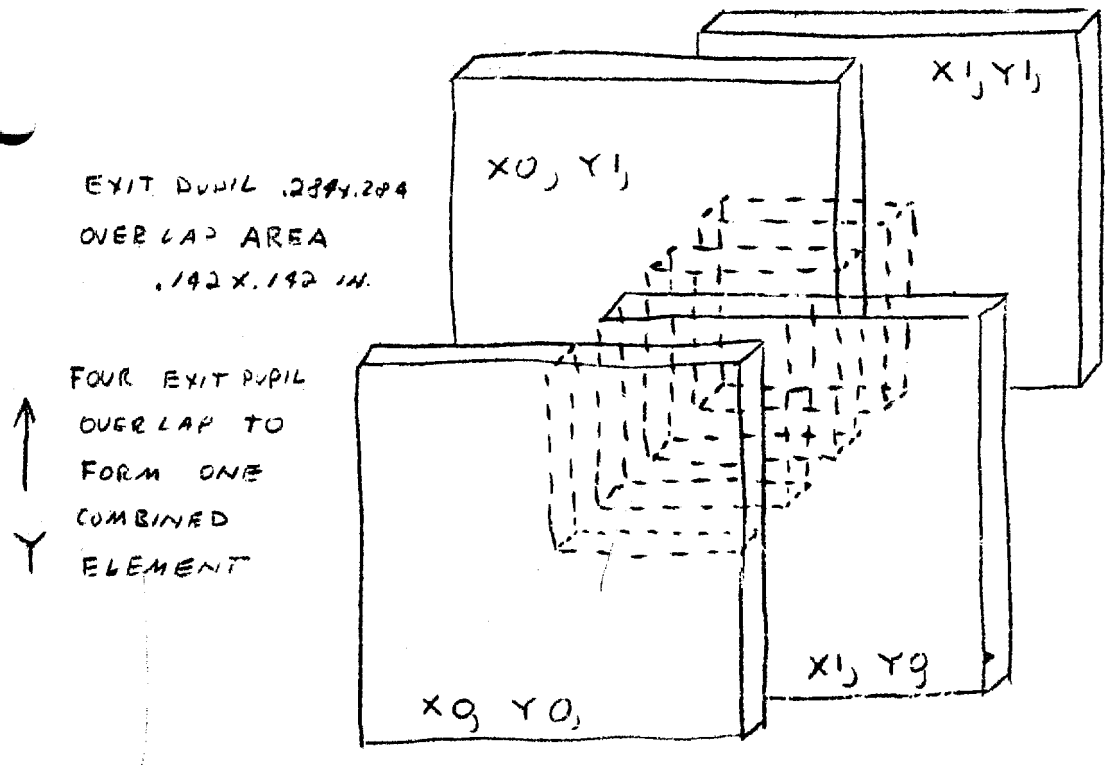
BY [redacted] DATE STATOTHR SUBJECT RELATION SHIP OF COMBINED EXIT PUPILS SHEET NO. OF JOB NO. 7506

CHKD. BY DATE



OVER LAP APPROACH

STANDARD METHOD



TYPICAL EXIT PUPIL OVERLAP

0 – 13 ORDERS

MEMORANDUM FOR: Robin

I have honestly tried to understand Ray's formula for T_{ab} and to determine what it really means. I have had absolutely no success, either in deriving the formula or interpreting it. If I have this much trouble, maybe he'd better be a bit more explicit in defining his terms, and what he means. Or perhaps this is an indication of how far my mathematical skills have slipped. In item 311, I believe the trial grating is still 2 x 2 in size - he may be looking ahead.

[redacted] STATOTHR

16 Feb 1965
(DATE)

FORM NO. 101 REPLACES FORM 10-101
1 AUG 54 WHICH MAY BE USED. (47)