Element H: Prototype testing and data collection plan

TESTING

All of the tests were authorized by [teacher's name redacted].

[teachers name redacted].... Engineering Teacher

The first visibility test procedure was written to test the amount of light reflected by certain material samples. The intent was to determine the ideal material to use in the Mirror Sections to reflect the light, thereby giving the device its periscope function. This test was labeled as Material Reflectance Test. The test document is as follows:

Material Reflectance fest (Orlginal}

Testing Oate:

Purpose: To determine the *percent* of light reflected by a sample of a material

Pass/Fal l Criteria: Pa$S- a value *for* the *percent* of fight reflected is determined

                Fail-*a* value for the percent of light reflected s not determined

Matrials Required:

1. materialsample(s)
2. dark room
3. Science Workshopinterface
4. Computer with Science Workshop softwar
s. PascoSC.ientlftec1-.6504A light sensor
6. laser pointer

Initfal Condltlons;

1. The area mu.st be dark with no visible ight sources other than the testing equipment.
2. Perrnirion to use the equipment has been granted.
3. Science Work.shop software has been installed onto the computer.

Safory Concerns:

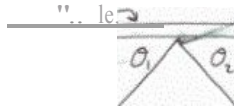| Hazard	Control	Compliance
1. ight emitted by the laser pointer may be direcied at .someone's *eye*. thereby potentially damaging the *eve*	IA. Only people necessary to the performance or hetest will be present in the datk room during the test.	IA.
	I8. the person ope.rating the laser pe>inter will be aware of the presertee and position of all people in the dark room and will make sure that he or she does not aim the. laser at anyone.	I8.
	C. No one will evef' be at eye level with the laser oointer.	IC.

Terrrnnat1ons:

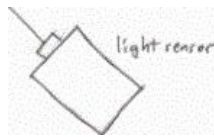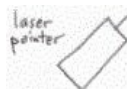1 The emitted laser ight damages someone's eye.

Stepwise Procedure:

1. Ensure that all required materials are on hand   COMPLIANCE:
2. Ensure that all ntial conditions are met   COMPLIANCE :

Material Reflectance Test (Original)   Poge2ol3

3. Em;urethatal1S1ftt1titmtrol.sarein p4ace   COMPtJANct.:

4. Optn11>t   Wo<shop10flw>roll'<'S'•m

5 StlupllIellGHTSENSOR irtpoJ>on ....PIOC'•m

6. Open the   ijbr'l ion bo<

7. PO!lliontilttight<en!Ot!Othat ltbeblorllillg ambient llgl1llrorn lIleroorn

8. Seltllisv•!Uoofliel>l »lhe mlnloklm ••h•

9. Shon• 1htInt' l'Ol•ter   cttyal •lletl&h1 ;oruor

10. Set this value offight as 'hemaxlmomvcilu.

11.Tum <>ll lhel>S« palnler

12. Clo••lllealolmllonbo•

1J S.ttl\t P•KO lfct>\ .,.<of D .,.. monotol" lunalon   d...OUlpul IQ the Or<;rTAL output

14. R«ord the material of ttwfirsi sample fnthe Rtflecc1ruditi! tilbfe

IS.Setup the _,pointer, Ille first samplo,   me lght sensor as !llowintile lollowlng diagnm

     wlttl one   onhokfinglhe Qmple end analhHJk'fSOnol)ff'atlng the'tar 3Nf ttwf sensor

16. Acllva lhe laser pointer and make •ur• thatany l'<!llected fill>l l$being rellec:t10d ittho llgbt
     sensor

17.Rec:ord lhe per<en!OJ• of light det«ed by th• liaht   ln th• Reft«IMl<• datir.ablt

18. Tum olf the laseq>oi<'l1er

19. Repeal steps l4th""'tlh18fOf any oddllion.>l ,mplos

Ai.rthoNed Sfcn.atute:

Data:

Reflectance	
material	light reflected (%)
~~mirror~~ aluminum foil	
~~foil~~ mirror	

Another visibility test had the purpose of determining any alignment errors in the mirrors in the visibility prototype. This test was called the Mirror Angle Test. The details of The Mirror Angle Test are included in the following test document:

Testin1 te:

rt *5 1/1 3*

PurpOSe: To determine the drlftrence: nJllgnment of the light enteringone vJewport of the devl<* and exiting the other viewport.

hss/Fall Criteria: Pass-The average artgnment difference from 90· [s S* or less.

Fail-The average abnment difference from 90· is areater than s*.

terlils Required:

1. devke prototype with mi1TOr sections attached
2. laser pointer
3. plain white computer paper
4. tape
S. protractor
6. ruler or straight edge
7. protractor sheet (Appe<1dlx A anac:.hed at the end of the test document)

Initial Condition5:

1. Permission to use the equipment has been granted.
2. A suitable test1ng area is found that is within three feet of a wall.
3. The testing area Is set up as specified the foUowing conditions:
   a. Set up th device prototype on its skle on a table with one viewport facing the wall, as shown In Figure 1.

Figure 1: _____

   b. Tape a sheet of plain white computer paper fn front of the device prototype viewpor't not facing the wall.
   c. Use the protractor and $lraight edge to draw a line perpendicular to the viewport that s not facing the wall on the sheet of paper n front of it, shown as line A in Fgure 2.
   d. Ready the laser pointer so that the light will be ditected ak>ng lineA on figure 2.
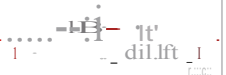
Figure 2:   w.11

\:l   J:,-t

m
!–"'l• tl',. ,—. tr

e. Activate the laser pointel'-at a downward ting!!:'- tnI$racfually angle it upward along the line, Continue to angle it upi.wrd untilthe t pof laser can be seen just outs.id!? of the viewport facing the waU. Hold ← laser pointer at this illlgle.

f. A second tes.tertape tne protractor sheet ff.-,o: cl the devke prototype viewport facing the wan with the horizontal line at the ge of th vi(..'\"Port touching the table or ground and the 'X' at the tip of the laser, as shown in figvre 3.

Figure 3: \'J.' _____

f"--:::t J,,,,,

0   lo.1tr
     vo...tr

g. Deactivate the laser p()ir\tef'.

h. Repeat t"ps (e) and (g) and make s;ure that the tiJ) of the laser hits the exact point of the '_

Safety Conce"""

Haz:ard	Control	Compliance
1light emitted by the laS<!r pointer may be directed at someone's eye, thereby potentlalfy dal"riaging the eye	1A. Onfy people necessary to the performance of the tet will be present within five feet of the test. 18. The pel'Son operating the laser pcintr will beawa reof the presenu and position of all people within five feet of the test1ng area and wltl make sure that he or she does not aim the laser at anvone. tC. No one will f!Ver beat eve level with the laser pointer. 10. The laser pointer will always be pointed in the direction of the wall.	1A 1C 1D

Terminations:

1. Any of the contr scenarios described in the Safety Concerns section above are no longer In compliance.

Sta.pw1se Procedure:

COMPLIANCE:

1. Ensure that all required mo1tteria ls ar on hand

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2. Ensure that all initial conditions are met   COMPLIANCE
3. Ensure that all safety controls are in place   COMPLIANCE:
4. Angle the laser pointer upward until a degree measurement off from the 90° mark on the protractor sheet canbe dtscerned.
S. Record this measvrement In the Angle Oiffereoce data table.
6. De.activate the tase.r pointer.
7. RePQ-O:t steps 4 through 6 for a total of five tl'ials.
8. Cabulate the avetag of the data in the Angte OUferenc!d:ata table.

Authottz Sign.ature:

1 (zA_ lol   Pf >

Datta:

Trial Number	Angle Difference Angle Measurement from 90°
	2° to the right
	1° to the right
	4° to the left
4	2° to the right
S	4° to the left

Appendix A