# CALIFORNIA STATE SCIENCE FAIR
## 2017 PROJECT SUMMARY

**Name(s)**
Arsh Muhib

**Project Number**
**J1813**

**Project Title**
## Building a 360 Degree Periscope

**Abstract**

**Objectives/Goals**
Build a 360-degree view periscope with no image disorientation, maximum comfort and minimum space requirement.

**Methods/Materials**
Materials - Cylindrical wine paper box, Mirrors, dove prism.

Obstacle 1 - Method - I modified a standard periscope such that the top mirror of the periscope rotates 360 while the bottom mirror stays stationary. I mounted the periscope mirrors on the cylindrical box in such a way that I could rotate the top mirror in all directions. Findings 1: When the position of the periscope mirrors were not exactly opposite to each other, then the image did not have the correct orientation.

Obstacle 2 - I conducted an experiment to understand the relationship between the rotation of the top mirror of the periscope and the image tilt.I rotated the top mirror of the periscope and measured the tilt of the image for each position. Findings 2: The degree of tilt in the image was equal to the degree of rotation of the top mirror of the periscope.

Obstacle3 - I had to fix the tilt. I found that dove prisms can be used to rotate an image. If you rotate the dove prism by x amount of degrees, it rotates the image by 2x amount of degrees.I mounted a dove prism in front of the viewing mirror of the periscope. I rotated the top mirror of the periscope and then rotated the dove prism at the viewing end until the image orientation was fixed. Findings 3: I could fix the tilt in the image of the periscope by rotating the dove prism by half the degree of rotation of the top mirror.

**Results**
I was able to make a 360-degree periscope where the top mirror of the periscope rotates in all directions. The mirror at the viewing side has a dove prism attached to it that can be rotated to cancel the tilt of the image. The observer did not have to change his/her position.

**Conclusions/Discussion**
A 360-degree periscope with no image disorientation and no observer movement can -
1. Make life of sailors and soldiers in submarines and armored vehicles much more comfortable.
2. Free up precious space in submarines and armored vehicles because of no observer movement.
I can do a lot of improvements like reducing the size of the periscope, provide magnification of the image, provide the observer a display of the direction in which the top mirror is pointing etc. I can build a single

**Summary Statement**
I built a 360-degree view periscope with minimum image disorientation, maximum viewing comfort, maximum stealth and minimum space requirement for an observer.

**Help Received**
My dad helped me wherever I had to cut and trim cardboard and wine paper gift boxes using a sharp object