



## VISION 4 MARS CHALLENGE

### **VISION FOR MARS TEAM RECOMMENDATIONS**

The *Vision for Mars Team* was briefed by NASA and NSBRI on the ophthalmic findings in astronauts during the November 6<sup>th</sup> conference in Houston. The team spent the afternoon discussing the needs and required technologies and made several important recommendations.

#### **There was a clear consensus on the top three issues:**

1. NASA was commended for collecting a rich ophthalmic data set, but additional approaches for analyses of existing data should be performed (for example, corneal curvature).
2. If the optical changes in flight do not correlate exactly with changes in globe length, periodic testing in flight for the exact refractive and acuity changes should be performed; preferably with an easy-to-use smart phone app.
3. A mechanical countermeasure that can modulate IOP (up or down) should be considered and tested first in an analogous population on Earth in patients with papilledema resulting from elevated ICP.

#### **The second tier of priorities included the following issues:**

1. In-flight contrast sensitivity / color vision should be assessed; preferably with smartphone apps.
2. Changes in corneal curvature / topography pre- and post-flight should be assessed, possibly using the Visometric HD analyzer.
3. More reliable intraocular pressure (IOP) measurements in flight should be obtained; hand-held NCT (by Welch-Allen) should be considered/tested for suitability for flight. Emerging technology for continuous IOP measurements using smart contact lenses should also be considered.

#### **Other topics to be considered:**

1. A condition on Earth called benign acquired hyperopia with choroidal fold should be explored as a model for the syndrome in astronauts. If this condition is deemed to be analogous, susceptible

emmetropic or hyperopic male astronauts with “crowded disks” will develop additional hyperopic shifts and likely get worst with long spaceflight, but are not likely to have permanent vision loss.

2. Individual anatomical differences in the ophthalmic nerve that can give rise to tortuous anatomy should be considered using high-resolution imaging.
3. A handheld wavefront Aberrometer could be used for objectively measuring refraction (in flight or any time).
4. IOP in space should be tested under conditions of extreme gaze using a using a Hertel Exophthalmometer to measure proptosis of the eye.
5. IOP in space should be measured by tonometry under conditions of extreme gaze to determine tension on the eye possibly related to tightening of extraocular muscles.
6. The Annidis multi-spectral imaging technology could be used pre and post flight and may identify abnormalities earlier than OCT.