Fabio Menna
3D Optical Metrology, Bruno Kessler Foundation (FBK)
Trento, Italy

"UNDERWATER PHOTOGRAMMETRY: WHERE DO WE STAND?"

To answer this question, we may first want to ask and clarify to ourselves what we consider underwater photogrammetry to be. Is underwater photogrammetry a simple submerged version of "regular" photogrammetry above the water?

For sure everything started when some ingenious scientists and craftsmen made it possible to capture an underwater scene through a camera placed in some sort of pressure housing. How things went after is very well testified by an extensive record of publications on mathematical modeling, calibration strategies, and different application reports. From these we see that not only did underwater photogrammetry start later but also grew up slower than its mother above the water. The basis for underwater photogrammetry are all there in those papers, the potential is absolutely clear, yet the actual state of underwater photogrammetry is very far from being comparable to "regular" photogrammetry above the water.

We have successfully applied photogrammetry from almost everywhere on our planet (and beyond), from very close range up to several hundred kilometers to remotely sense and monitor within few hours a same place on Earth. We have even explored and mapped other celestial bodies besides Earth, but we are still missing almost 70% of the remaining part of our planet, that part that lies on the bottom of our oceans. Not only is this part fundamental for our lives (giving us half of the oxygen we breath and acting as litmus test for the state of health of our planet) but it also sheltering traces of our past, enclosing important energy, natural and cultural resources.

This will be probably the innovation driver in photogrammetry and related techniques for underwater recording for the future to come: a complete high-resolution mapping of our planet, below the water! This necessarily means that underwater vehicles with an elevated level of automation will need to be equipped with optical and acoustic sensors requiring proper data fusion techniques. Indeed, we do not have to forget that underwater, remote sensing necessarily means sonar, given the strong absorption of light underwater. Also, direct georeferencing is not as effective as above the water, given the fact that underwater we still miss a global positioning system. This opens many more interesting questions with respect to independent check and validation of photogrammetric measurements as high accuracy underwater surveying is still impractical or too expensive.

If we then look at huge amount of underwater imaging systems available on the market, their optical characteristics and mechanical stability, an extensive and more complete camera parameterization need to be sought and fine-tuned to the specific cases. This will definitely reduce the amount of ground control points needed to mitigate the bending of the photogrammetric model due to incomplete mathematical modeling.

Last but not least, small ROVs have come out on the market recently and this will definitely be beneficial for the community as it was above the water with UAS.