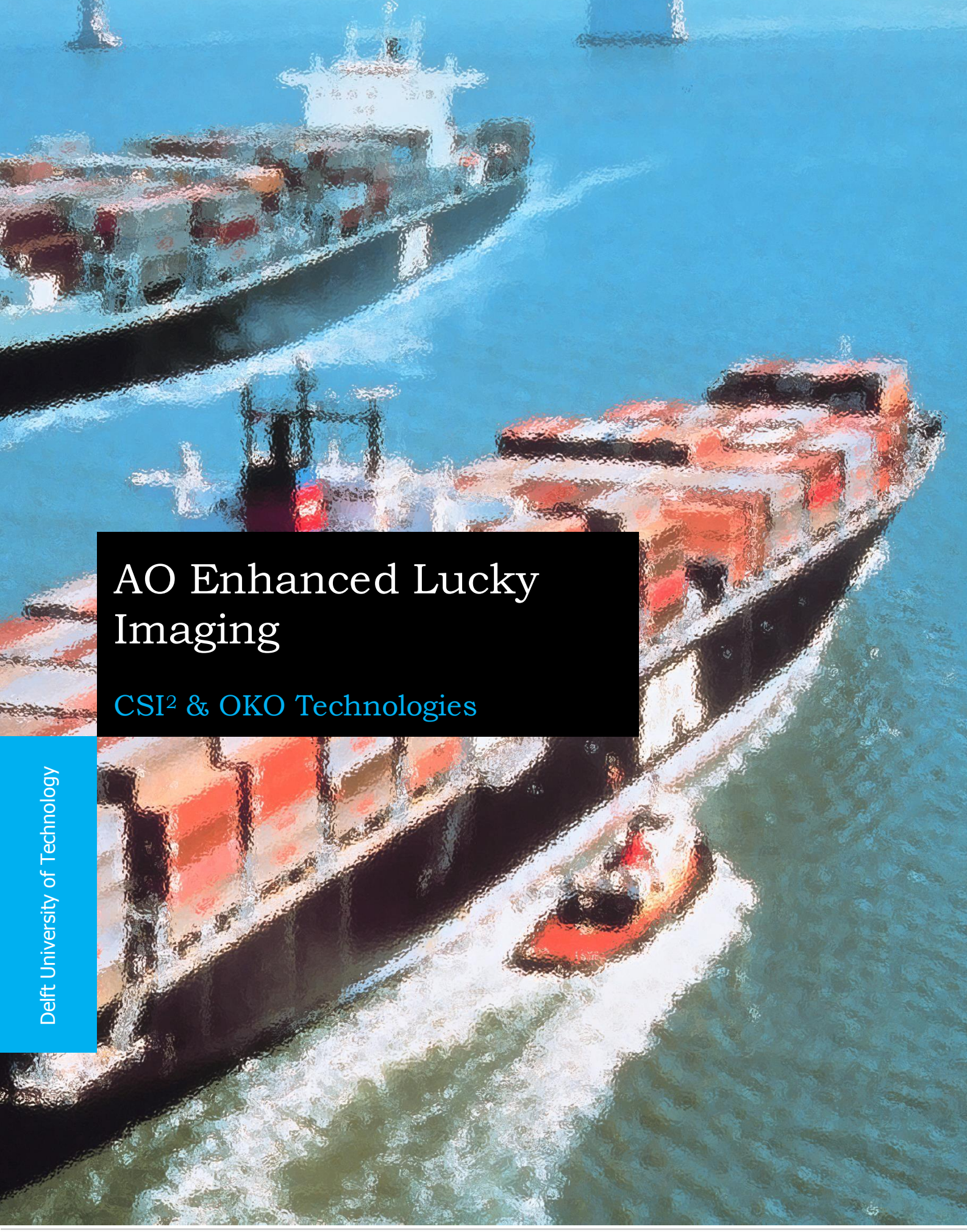
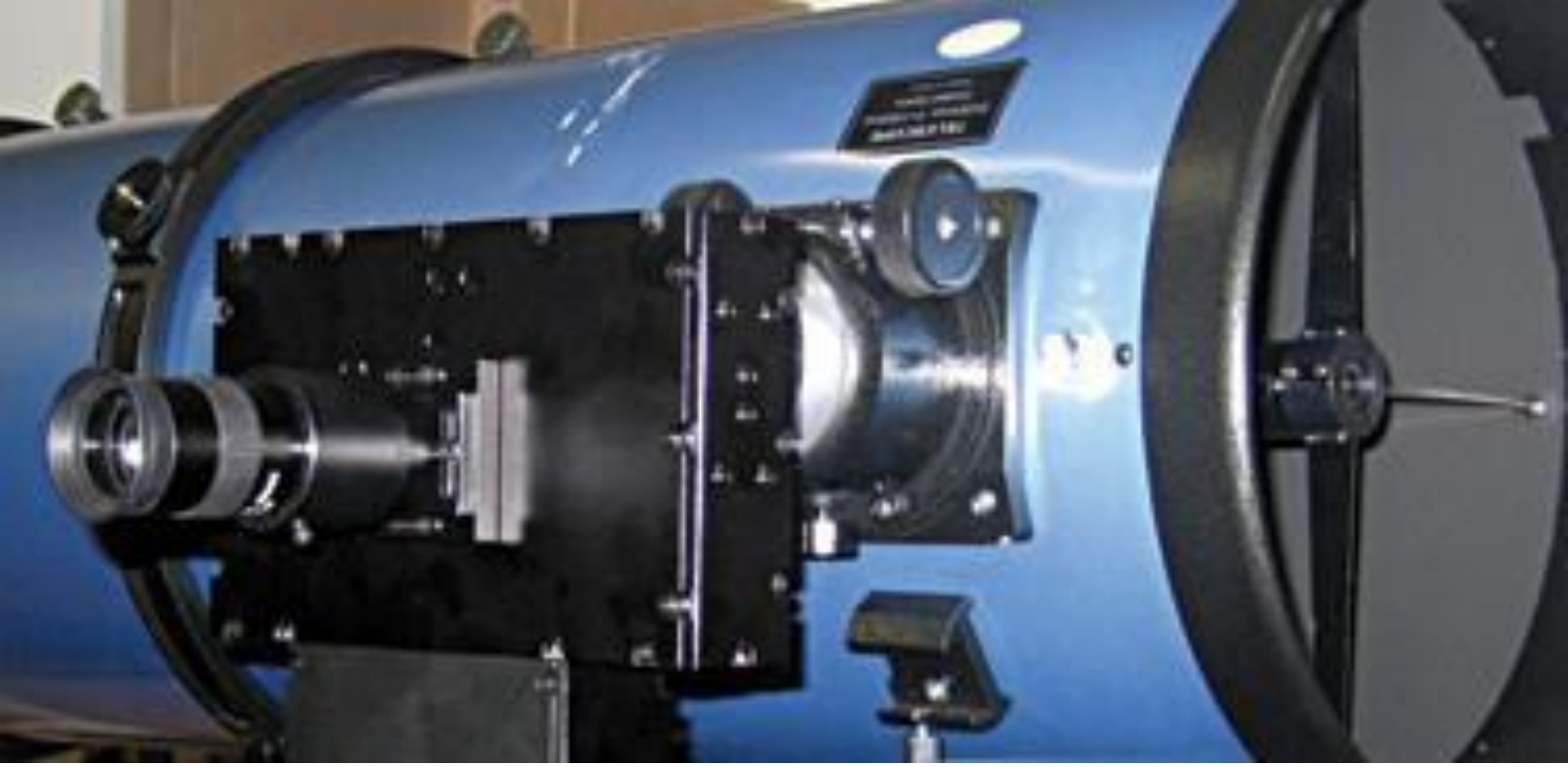


AO Enhanced Lucky Imaging

CSI^2 & OKO Technologies

Delft University of Technology

TU Delft Delft University of Technology



AO enhanced lucky imaging in turbulent conditions

Prof. Dr. Gleb Vdovin

Room Number 34 C-1-330
Email g.v.vdovine@tudelft.nl, gleb@okotech.com
Project Term 2014-15
Keywords Adaptive Optics, Optical Coherence Tomography
Level Master's or Bachelor's

The project is based at OKO Tech (Flexible Optical BV)
Polakweg 10-11, 2288 GG, Rijswijk. http://www.okotech.com

Introduction

Long-range surveillance has numerous military, security, and navigation applications. One example from current news: It is critically important to distinguish a Kalashnikov assault rifle from a paddle in the hands of a suspected pirate, when the potential danger is still far away.

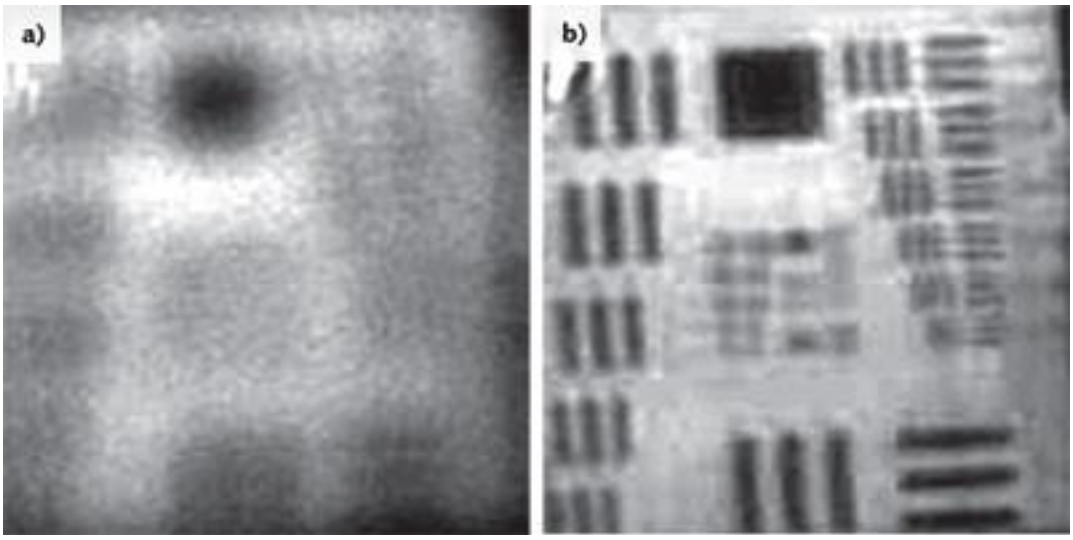
Project Approach

The project addresses the problem of high resolution imaging in quickly changing turbulent conditions. Active correction with adaptive optics can be an efficient approach, however it requires an extremely complicated control systems and very fine alignment. Therefore we will have a look into simplified approach to adaptive optics that would use only the information that is already available in the imaging system:

- Assuming the turbulent aberration is a quasi-stationary process with measurable statistics, we will design an adaptive optical system with stochastic feedback, acting based on the available "frozen" information about the turbulent atmosphere. Although this stochastic

feedback may or may not improve the average image quality, it should increase the probability of getting a high-resolution "lucky" frame.

- The project includes the design and 3D printer fabrication of an adaptive optical attachment to a telescope; development of software interfaces to the imaging camera and the deformable mirror, and development of a control algorithm to characterize the turbulence and to drive the mirror with a feedback that would increase the probability of a lucky image in a series of images.



A USAF resolution chart at 2 km without (a) and with (b) correction.

More Information

1. http://en.wikipedia.org/wiki/Lucky_imaging
2. D. Fried, "Probability of getting a lucky short-exposure image through turbulence," J. Opt. Soc. Am. 68, 1651-1657 (1978).
3. http://www.laserfocusworld.com/articles/print/volume-48/issue-03/features/turbulent-surveillance-or-how-to-see-a-kalashnikov-from-a-safe-distance.html