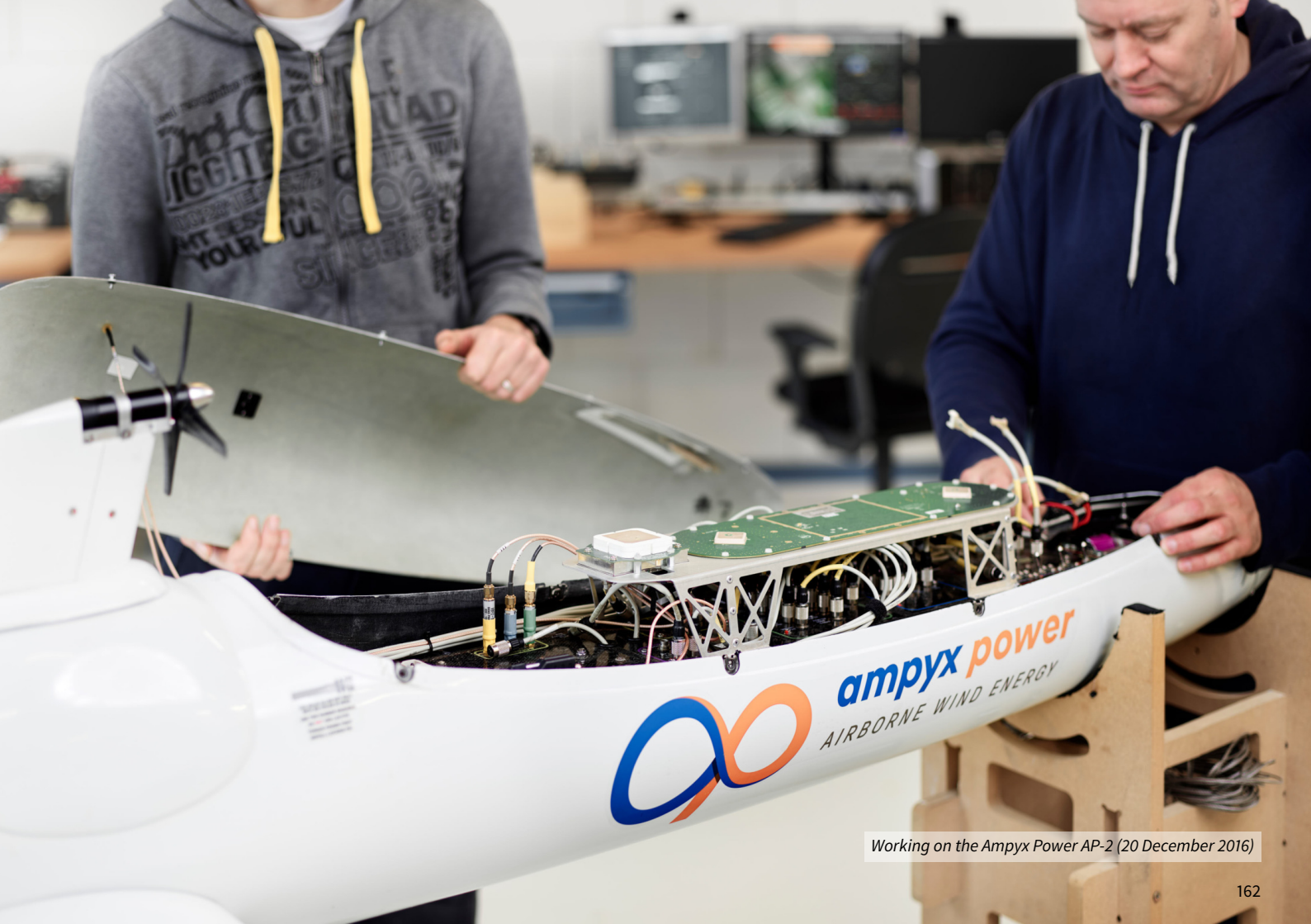


Working on the Ampyx Power AP-2 (20 December 2016)

Giovanni Licitra

PhD Researcher
Ampyx Power B.V.

Lulofsstraat 55 – Unit 13
2521 AL The Hague
The Netherlands

g.licitra@ampyxpower.com
www.ampyxpower.com

System Identification of a Rigid Wing Airborne Wind Energy Pumping System

Giovanni Licitra[1,2], Paul Williams[1], Sören Sieberling[1], Moritz Diehl[2]
[1]Ampyx Power B.V.
[2]University of Freiburg

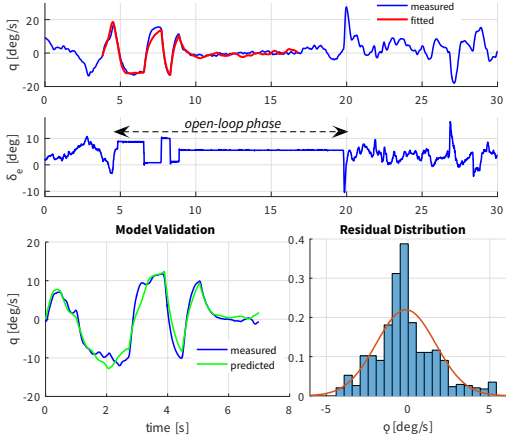
Airborne Wind Energy (AWE) refers to systems capable of harvesting energy from the wind by flying crosswind patterns with a tethered aircraft. Tuning and validation of flight controllers for AWE systems depends on the availability of reasonable a priori models. Due to the non-conventional structure of the airborne component, an intensive flight test campaign must be set in order to gain additional insight about the aerodynamic properties.

In this paper, several aspects related to the system identification of the airborne component of a rigid wing AWE pumping system are provided. The studies rely on the second prototype AWE system developed by Ampyx Power B.V.

More precisely, aerodynamic coefficients are estimated from real flight tests using an efficient multiple-experiment model-based parameter estimation algorithm [1]. Mathematical models rely on the full six degree of freedom aircraft equations of motion. Both model selection and estimation results are assessed by means of R-*squared* value and confidence ellipsoids.

Subsequently, optimized maneuvers are computed by solving a model-based experimental design problem that aims to obtain more accurate parameter estimates and reduce the flight test time [2].

Finally, several theoretical and practical aspects of the proposed methods are provided.



Data fitting and model validation along the longitudinal dynamics computed from real flight experiments [3].

References:

[1] Licitra, G., Williams, P., Gillis, J., Ghandchi, S., Sieberling, S., Ruiterkamp, R. and Diehl, M: Aerodynamic Parameter Identification for an Airborne Wind Energy Pumping System. IFAC World Congress, July, 2017.

[2] Licitra, G., Bürger, A., Williams, P. Ruiterkamp, R. and Diehl, M: Optimum Experimental Design of a Rigid Wing AWE Pumping System. Submitted to Decision and Control (CDC), 2017 IEEE 56st Annual Conference on. IEEE, 2017.

[3] Licitra, G.: "Optimal System Identification Flight test". https://www.youtube.com/watch?v=KBq5TTTOqf8