TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	**ASM-based SPS for AES**
Title	**Asynchronized Synchronous Motor based Shipboard Power System for All Electric Ship**
ERIGrid Reference	**04.004-2018**
TA Call No.	**4**

HOST RESEARCH INFRASTRUCTURE			
Name	**ICCS-NTUA**		
Country	**Greece**		
Start date	**30/09/2018**	**Nº of Access days**	**19**
End date	**26/10/2017**	**Nº of Stay days**	**27**

USER GROUP	
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1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)

1) Objectives: Validation of the control strategies of the synchronous generator (SG) and back-to-back (BTB) converter in a control hardware-in-loop (CHIL) setup, with the power hardware components simulated in the real-time digital simulator (RTDS).
2) Set-up: The set-up of the real-time simulation is illustrated in Fig. 1, where the power circuits of SG and its excitation system and governor, and the BTB converter are simulated in the RTDS, and the control algorithms for BTB converter are implemented in a hardware controller.

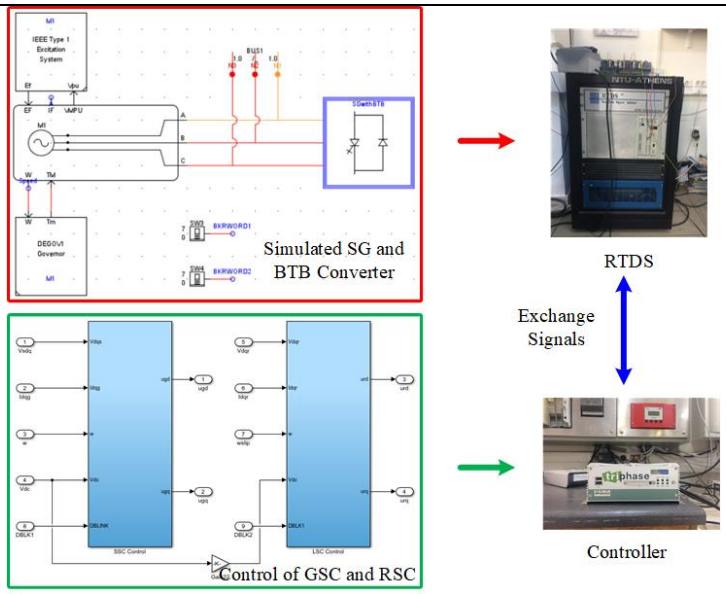

Fig. 1. Real-time simulation platform set-up

3) Methodology: The power circuits of SG and BTB converter are built up in RTDS software, with the rotor of asynchronized synchronous motor (ASM) simulated as a three-phase voltage source.
4) Approach: The synchronous angular frequency and angle are obtained by using a phase-locked loop (PLL) for the three-phase stator voltages of the SG, and the rotor angular speed and angle of ASM are derived by a PLL with the slip frequency. The IEEE Type 1 excitation system and a governor are used in the RTDS software to control the operation of SG. The Park and Inverse Park Transformation blocks are implemented in the RTDS software, while the control blocks for BTB converter in the dq reference frame are built up in Simulink and implemented in the CHIL setup.
5) Motivation: The concept of all electric ship (AES) emerges to realize extensive electrification for modern ships, which reduces fuel consumption and increases the on-board power utilization rate. The normal operation of a commonly used fully decoupled shipboard power system (SPS) depends on power electronic devices, which are fragile and easy to break down. By applying the proposed partially power decoupled ASM-based SPS, the system robustness to power converter faults in increased and it becomes easier to isolate the faults.

2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

1) Results: The normal operation of a SG connected to a BTB converter with a rotor-side three-phase voltage source is verified in the RTDS with a CHIL set-up.
2) Conclusions: *a)* More realistic situations are applied by employing CHIL set-up and RTDS.
b) The tracking performance of the rotor-side controller is validated.
3) Lessons Learned: *a)* Establish power circuits in RTDS software and run simulations in RTDS. *b)* Addressing issues that emerge from the appliance of the control algorithm in realistic conditions (noise, time delays). *c)* Implement and verify the control algorithms with CHIL set-up. *d)* Tune the controller gains for vector control of the system.

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

1 journal article and 1 conference paper will be published based on the achievements.
In addition, the results of this proposed research will be involved in the training process for the undergraduate and MSC projects in University of Liverpool (UoL).