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M3Or4A-04 [Invited]: Development of fully turbo-electric propulsion systems for aircrafts

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In Japan, aiming for low emissions of aircrafts, the national project for the development of electric propulsion systems began last June. First fully turbo-electric propulsion systems for e-aircrafts have been conceptually designed. Output power was set to 20 MW for aircrafts with around 150 passengers, such as B737. The propulsion system is composed of fully superconducting generators, motors, cables, cooling system and also inverters which can operate at cryogenic temperature. If necessary from the viewpoint of dielectric strength, superconducting transformers also should be installed between generators and inverters. Whole of the superconducting propulsion system is cooled by forced-flow subcooled liquid nitrogen at 65 to 75 K. The fuel was supposed to be LNG in the near future and LH2 in the distant future. The weight and size of the constituent machines and devices were estimated after electrical and mechanical design with some assumption. Next the weight and volume of the required fuel, AC loss generated in the superconducting windings and the total efficiencies were quantitatively estimated by making a theoretical consideration and a numerical simulation. As a result, it was concluded that the output power density of the electric propulsion system in total may attain to 10 kW/kg. In addition, the body of B737-series aircrafts can have whole of the designed propulsion system on board. In this conference, we will report the details.

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