

## Sviluppo ed Analisi Termofluidodinamica di un Modello di Camera di Crescita di Piante per Applicazioni Spaziali

This work thesis aims to answer the troubles of the next space exploration missions .

Infact, space programs, as LUNA GAIA, aim to bring humans in the space for long period missions, so the great problem is food resources to support human life for an approximate period of 3 years.

The solution is ECLLS (Enviromental Close Loop Life Support) ,which uses human fluid waste products (CO<sub>2</sub> ,gray water,etc) to feed biomass. It returns water, food and oxygen to man .

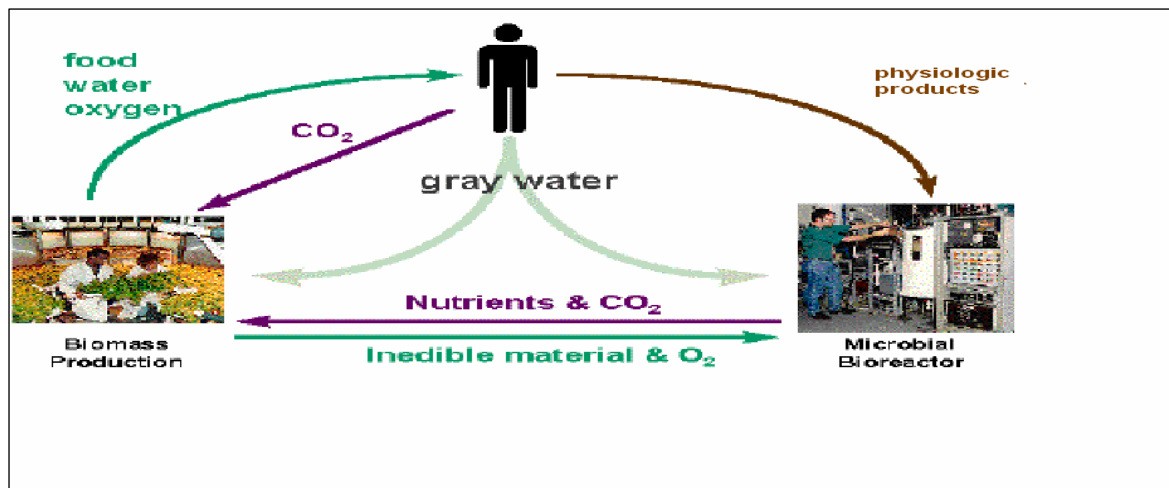


Fig. 1 ECLLS

This brought ASI to focus it's attention on CAB (Bio-regenerative Enviromental Control) ,which aims the following goals:

- \* Production and food management;
- \* Air regeneration ( O<sub>2</sub> production, C O<sub>2</sub> removal and gas control );
- \* Water regeneration ;
- \* Waste management .

Thanks to studies on the plants biology and physiology and themofluidodinamic processes within plant, the Space Aeronautic Department(DIAS) ,with MARS Center and Faculty of Agriculture , developed a close loop climate chamber .

The goal of the thesis has been to optimize the process of interaction between vegetation and the environment in which to create a Space Greenhouse(SGH) in the future.

The work based targets are :

- \* The optimization of the environmental conditioning system(based on an environmental plan system to recreate a good environment for the plants' growth ).
- \* The development of prediction model for plant-environment interaction, based on thermofluidodynamic rules) ;

Once achieved the requirements to obtain a good environment for plants development, I studied the photosynthetic process , the plant transpiration and convection so that I implemented the mathematical model considering the CO<sub>2</sub>.

To compare experimental results, I made numerical simulations in CFD(Computational Fluid Dynamic) with and without plants in order to compare the end final results with the experimental once.

Each time, during these simulations, I changed one or more thermofluidodynamic parameters( for example Temperature ,Global Radiation etc).