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Trade Study Method for Determining
The Design Parameter of CELSS Subsystems

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INTRODUCTION

Essentially, the environment of closed sphere of earth has naturally been evolved and the human's prosperity owes to an easy accessibility to necessary materials such as foods and oxygen provided by, mainly living organisms. For example, plants use carbon dioxide in photosynthesis release oxygen and produce biomass. The excretions of animals(including human) are decomposed into the inorganic matters by the function of micro-organisms. Plants can be thus described as a bio-reactor having reverse function of animal metabolism. The useful materials inclosed sphere of earth is balanced between them.

In order to conduct the study of ecological change to be applicable to an environmental study on earth, CEEF(Closed Ecology Experiment Facilities) is now constructing by non-for-profit organization in Aomori.

This paper is to deal with the design method of facility through determining material balance. For example, Fig.1 shows the material flow of plantation area.

INSTALLATION PURPOSE

Installation purpose of experiment facility is as follows;

- Experiments related to environmental issues on earth.

In order to fulfill the purpose;

- 1.Three independent modules are to be installed, plantation, habitat and breeding.
- 2.Three kinds of independent material recycling facilities related each module are to be installed for keeping the independency.
- 3.Variable connection modes between each module are to be realized for establishing multipurpose usage.

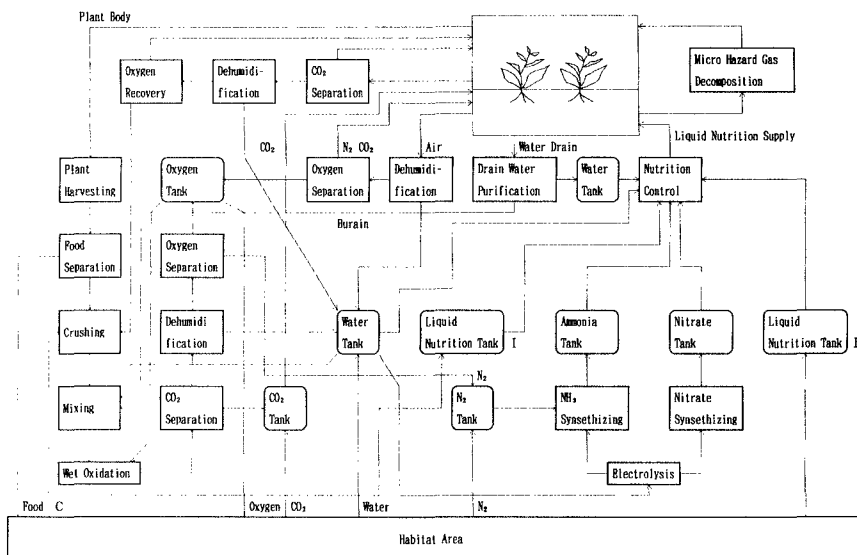


Fig.1 Materials Circulation in Closed Plantation Area

SYSTEM CONFIGURATION LEVELS

In order to keep the independency of each module function and define required material flows between each module and between the subsystems of each modules.

The function of total facility has been divided into system configuration levels as follows; LEVEL-0 is the material flow level between the total closed loop life support facility and outside.

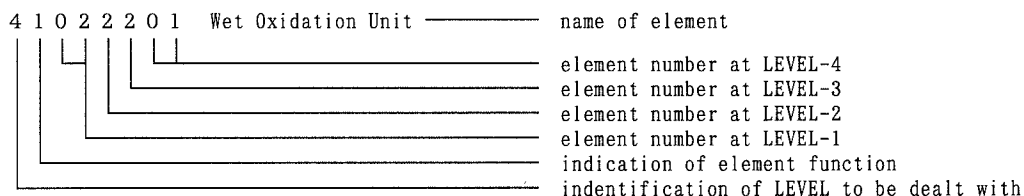
LEVEL-1 is the material flow level between the plantation, habitat and animal breeding modules and their supporting systems.

LEVEL-2 is the material flow level in the plantation, habitat and animal breeding modules and their supporting systems.

LEVEL-3 is the material flow level between each subsystem in each module and in their supporting systems at LEVEL-2.

LEVEL-4 is the material flow level in each subsystem at LEVEL-3.

According to these levels, each element such as facility, system and subsystem is given a number as follows;



Based on studies for determining the required flow quantities at each LEVEL the final design values for each subsystem are to be decided.

For example, Fig.2 shows studing process for determing the material flow in LEVE-1 and subsystems in LEVEL-2.

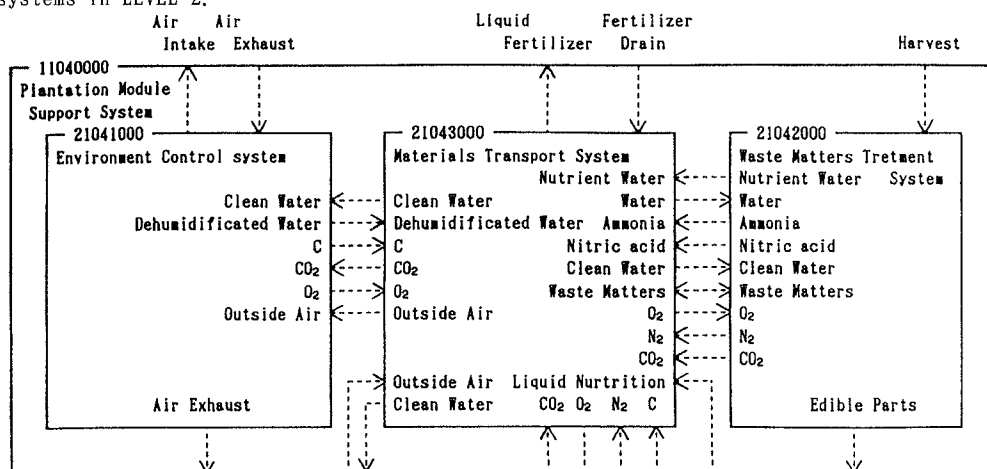


Fig.2 Material Flow in LEVEL-1 and LEVEL-2

CONCLUSION

The designed and constructed facility of experiments by this methology will enhance the analytical capability regarding earth environmental problems initiative in next decade.

REFERENCE

Keiji Nitta(IES):Biosphere Research Plan in japan; CELSS JOURNAL Vol.4 No.1 1991