Formal System Engineering Design Tools for nPods and PodAtriums

nDLS, nPL, nDOCSIM [1]

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Introduction and Recap re: nPods and PodAtriums
This workbook is intended to be complementary to others including PPT/PDF graphics-oriented workbooks that provide basic illustrations and some introductions of concepts and definitions.

The design, fabrication, installation and operation of modular mobile structures known as nPODs (CyberPODs, or simply, PODs) and multi-nPOD structures known as PodAtriums, is the foundation for many innovations and advances in the use of diverse and complementary technologies for solving present-day and emerging tasks economically and efficiently. These nPODs and PodAtriums are functional, modular, and "organic assembly" structures that include in most cases specialized equipment including instruments for energy, environment, health and/or security functions, but within the span of practical applications are also residential, fabrication/assembly and exploratory uses on Earth and in Space. A PodAtrium is a structure that enables interchangeable functions, locations, and architectures, rapid assembly and disassembly for transport and reconfiguration. The archetypal physical design allows for the efficient and economical introduction of new onboard equipment as well as structural materials. The architectural foundations have been likened to Lego, K'nex, and similar geometry-based models.

An earlier design, StarGate Alpha (SGA), provides for a unique PodAtrium structure that can provide site-based, mobile and remote demonstration, education and field-use applications [1]. Due to the combined needs of more than one medical-sciences research program as well as several community public education and youth-science initiatives, a confluence of humanitarian and social entrepreneurs engaged in serving both emergency and chronic long-term needs around the world, plus the increasing importance for a compact and easily "visible" demonstrator system, attention has now moved to the **BSL-PodAtrium** which is specifically designed to provide a mobile-capable **Bio-Study-Lab** with public health, community education, emergency response, and basic field research applications. The BSL-PodAtrium[2] ("BSLP") provides the foundation for clarifying the entire design and

[1] Note: earlier versions can be found in Ecoaduna-StarGate-01v1_01.doc/pdf and various StarGate graphics workbooks.

[2] Herein, "BSL-PodAtrium" may be abbreviated as "BSLP"

its specifications, including the computational formalism and software systems by which all nPods and nPod assemblies such as PodAtriums can be efficiently, accurately, and economically designed, assembled, maintained, disassembled, relocated, and otherwise used most effectively. The initial BSL-Podatrium being designed and constructed presently for use in rural Michigan (code-named "Rainbow", a PIDP system – Public Health, Infectious Diseases and Pandemic Prevention) will provide onsite and online demonstrations of what are PodAtriums and how they are utilized within multiple specific application areas for homes, schools, clinics, businesses and their communities.

<u>Review of applications of nPods and multiple-nPod systems including PodAtriums</u>:
Some of the specific and most in-demand applications are:

- public-health biomedical testing and diagnostics (focus: infectious diseases and food/water safety)
- hydroponic agriculture (focus: vegetables, herbs and fruits)
- environmental air-liquid-solid testing (focus: HRVOC (highly-reactive hydrocarbons) and heavy metals) - especially for the petrochemical and mining industries)
- emergency response and relief (focus: water, power, onsite power tools and remote broadband internet services for communities in disaster situations)
- residential use (focus: modular living, cooking and sleeping quarters, both emergency/temporary and permanent)
- hybrid non-petrochem energy generation (focus: provision of low-cost, low-maintenance net-zero residential/commercial energy applications)
- exploration and engineering tasks related to energy generation and space-based operations.

Presently, our focus is upon the biomedical domain and the growing challenges of emergent new strains (including resistant varieties) of pathogenic microorganisms, spanning from prions to viruses to bacteria to parasites, but particularly upon pandemic-potential viruses such as influenza and epidemic-potential food-borne and water-borne pathogenic agents.

We are also intent upon demonstrating that a PIDP type of BSL-PodAtrium is the foremost among systems to be set up and put to use in many diverse communities around the world because of the need and the ability to provide more than a unilateral and often "community-passive" medical facility. We aim to demonstrate-by-doing that in all of these uses, and in all of the phases of design, construction, and operation for nPods and PodAtriums, there are four central, common, synergetic threads of activity using the PIDP-1 BSLP:

- <u>*education*</u> (specific youth/student-engaged projects, team-oriented and individual, in conjunction with nearby community schools and families)
- <u>*employment*</u> (focused upon a broad base of skilled workers in the nearby communities)
- <u>*engineering*</u> (efficiency and ergonomics through common platforms using the same "core" material and equipment components for shared-use applications)
- <u>*economics*</u> (generation of sustainable, diversified and resilient profitability through the production and commercialization of PodAtrium components and systems, serving a global needs-market).

Thus, we are taking a substantively and philosophically Different Approach to solving more than one chronic problem facing very large numbers of people in very many communities worldwide, by employing comparatively simple, reliable, and low-cost solutions that also bring to bear upon the situation the very latest and most modern in medical, energy, communications and social technology.

A Brief Taxonomy of the nPOD Architectural Family

nPODs are Purposive Operational Design Structures (residence, fabrication, commerce, specialized uses for energy, environment, health, security, exploration, emergency and disaster response).

A PodAtrium structure consists of standardized nCube, nRec and other nGon (including ROC) modular nPOD component units. These 3D structural units comprise the fundamental core of the nPOD (aka CyberPOD) architectural family and are compatible with other nPOD structural components (APOD, CPOD, RPOD, TPOD).

(For definition and clarification of different terminology, consult later sections in this document (including the Technical Appendix), or other graphical workbooks on nPods and Podatriums).

nPOD-based systems such as PodAtriums are composed of one or more interchangeable and scalable components. A component may itself be any type of nPOD (nCube, nRec, other nGon (e.g., ROC or TET), APOD, CPOD, RPOD, TPOD). The "n" prefix indicates that there may be multiple components ("organisms") in one complete system and also that these components may be of different types ("species"). Generally, nPODs are assembled in a 1d or 2d configuration; however, 3d structures are also enabled in the system architecture.

Components are composed of structural elements or "SE". These may be interchangeable among different component types. For nCube, nRec, nGon and RPOD nPODs, a structural element (SE) is an assembly that is fabricated from steel tubing or carbon composite parts and for which there are a variety of possible external and internal panel/sheeting materials for walls, windows, doors, and other coverable sections. APOD, CPOD and TPOD components are pre-assembled units manufactured separately.

Structural elements are composed of combinations built from what are called Base-Elements ("BE"), such as rods, tubes, and cables, with Joiner-Elements ("JE"), devices that serve to link two or more BE into a structural element (SE).

There are two fundamental types and eight main subtypes of nPOD component:
The two fundamentals are:

nGon

One or more vertically-contiguous, connectable structures, each of which is built with PFS elements; a given nGon has four or more faces (sides), the most typical designs being an octagon or hexagon structure. Any other nPOD component may, in principle, be joined with any nGon face. A ROC (rhombicuboctahedron) nGON is a

PFS-fabricated “great rhombicuboctahedron”. The nGon is the most geometrically diversified class of nPOD component. See Figures 2D through 2H.

xPod
One of four different kinds of nPod that originate with pre-assembled structures: air-inflated rooms, shipping containers, modular frame units, or trailers.

Each fundamental type has four main subtypes.

nGon
nCube
One or more contiguous, 3D-connectable cubical structures, each of which is built with structural elements known as Alpha-square, Beta-square, Gamma-square and Delta-square; multiple nCubes may be combined into unitary, integrated structures that are elongated rectangular prisms or more complex structures with one, two or three axes (dimensions). The nCube is the simplest and most common type of nPOD component.

nRec
Very similar to an nCube but with four rectangular faces, thus forming a right-rectangular prism. One or more contiguous, 3D-connectable parallelogram structures, each of which is built with structural elements; multiple nRecs may be combined into unitary, integrated structures that are elongated rectangular prisms or more complex structures with one, two or three axes (dimensions). The nRec is the second simplest and one of the most common types of nPOD component.

ROC
Great rhombicuboctahedron geometry.

TET
Tetrahedron geometry.

xPod
APOD
An air-inflated structure, typically rectangular base and arched roof, with sides either vertical or integrated into the curve of the arched roof. There are many sizes and varieties of APOD that can be employed as an nPOD or as a component within a larger and more complex nPOD. See Figure 2M.

CPOD
A pre-fabricated shipping container base that has been customized into an nPOD component such that it can be connected with other nPOD components (and not only other CPODs). See Figure 2I.

RPOD
An nPOD component unit built from PFS-fabricated panels that are in three basic sizes with pop-out sections for doors, windows and equipment passageways, formed into rectangular-prism nPOD components; any number of them can be connected into unitary right-angled assemblies. See Figures 2J through 2K.

TPOD
A prefabricated trailer-based nPOD component with a customized interior and features for structural and/or systems-integration attachment with other nPOD components. See Figure 2N.

BSL-PodAtrium PIDP-1 ("Rainbow")
PIDP-1 is set to be deployed at a site near the north bank of the Manistee River along Coster Rd. in Kalkaska County, Michigan. The site has been chosen for a number of reasons including:

- proximity to locations to be used for field monitoring and testing of wildlife and domestic animals (esp. birds and poultry)
- proximity and ease-of-access to area public schools in order to facilitate a number of planned student-participation science/tech projects
- proximity to "drop-in" visitors such as persons traveling to/from the Traverse City and Petoskey regions, for tourism or business in many cases, and who have an interest to learn more about ell of the different aspects of nPods, PodAtriums and their uses, including especially for disaster-affected and/or impoverished regions of the country and the world.

PIDP-1 is intended for multiple uses beginning with the immediate onset of assembly:
Demonstration of nPOD components and equipment of the engineering concepts, design, fabrication, and customized engineering for clients in both the private and public sectors;
Educational STEMA projects for students and young adults in Fife Lake Township school district and from adjoining communities in Grand Traverse, Kalkaska, Wexford and Missaukee counties, with open options for participation by members of other communities in Michigan and elsewhere;
On-demand community use of PIDP-1 as a biomedical testing and monitoring facility with BSL-2/BSL-3 capabilities, plus its full roster of components and onboard equipment, for emergency, disaster and special-situation applications, by appropriate agencies and groups within the greater NW Michigan Region and by special arrangement in other parts of the world;
Contractual demonstration and testing of third-party equipment including analytical instruments, generators, construction materials (structural, interior and exterior), telecommunications, and operating methodologies (e.g., for prevention of damage due to extreme events, natural or otherwise, defense and security);
Specific biomedical research relating to microbiology, epidemiology and immunology that is being conducted by and with the support of ECOADUNA Foundation.

PIDP-1 is assembled from four nPods, each of which is an nRec type. The adjoining of the four nPods creates a central Atrium space that is independently floored and roofed, and on top of the atrium is a structure known as the Atrium-Cap. Refer to BSL-PodAtrium_v1_01_mjd_12may13.ppt/pps/pdf for more on the BSL-PodAtrium including the specific PIDP-1 system.

Formal Tools for Design, Specification, Production and Operation of nPods and complex nPod Structures
This is the main body of this document.

Note: THERE IS STILL NEED FOR SUBSTANTIVE EDITING AND REVISION DUE TO CHANGES SINCE APRIL, 2013

nPOD Design and Layout Schema (nDLS)
The purpose of the nDLS is to make everything easier with respect to planning, assembling, and using any nPod systems. nPODs are described by a logical schema that identifies specific coordinate locations for all elements and for all equipment that is positioned on nPOD component faces including floors and ceilings. By referencing a specific nDLS identification code, one can know where any specific piece of equipment or structural part is or belongs. This section presents an introduction to the nDLS and contains some technical terminology.

The full abstract nDLS for a given nPOD object is:
[nPOD identifier].[nPOD component identifier].[nPOD sequence location].[nPOD component type].
[Face identifier].[Entity-coordinate-location set]. [Position-orientation set].
[Specification-attribute set].[Constraint-discriminator set]

Each of these informatic elements is described in detail below. Note that not all of these descriptive identifiers are required and the latter three are most likely to not be employed in many nPOD nDLS specifications.

The nDLS specification formalism is employed for describing all structural features and included equipment and provisions within a given nPOD. This is critical for design, planning and logistics with respect to devices and materials that are used in fabricating and outfitting any nPOD. The above nDLS formalism allows designers to indicate exactly what object x is used or will be located at any given location within an nPOD.
The same basic nDLS is employed for describing a given nPOD component, such as a free-standing nCube or an element of an nCube. A Face is typically the most basic element used in nPOD structural fabrication and assembly; everything of greater detail will be objects such as partitions, doors, windows, stairwell units (ladder or spiral types), furnishings, utilities (power, water, air, communications, etc.), and equipment such as machines and instruments.

Within the nDLS syntax, a given nDLS expression must begin with an nPOD identifier or an nPOD component type. These have some particular grammatical rules which are described below.

As one can clearly see, the nDLS enables the use of a simple "algebra" for carrying out operations for configuring a given nPOD and for moving system resources at any scale – from the component level down to specific pieces of instrumentation, machinery or furniture and supplies, from a supply base (warehouse) to a given nPOD or one of its components, or from one nPOD to another. (This algebra is not described here and the details will be worked out later in due course.)

Using EBNF (Extended Backus-Naur Form), we can describe the nDLS a bit more formally:

<nPOD_id> ::= <unique_name> /* old def <nPOD_id> ::= 'nPOD_' <unique_name> */
<unique_name> ::= <ent_id> /* de facto, at least three characters, using "a-z", "A-Z", "0-9" */
<nPOD_component_id> ::= <core_component> | <aux_component>
<core_component> ::= 0 /* a unique central core element such as an OctaPod for an octagonal PodAtrium */
<aux_component> ::= 1 | 2 | … | 255
/* a unique component or component-location; these begin in an arbitrary "North" direction and are numbered consecutively in a clockwise direction; 255 is arbitrary cut-off */
<nPOD-seq-loc> ::= 1 | 2 | … | n /* in theory, there is no limit but 3 or 4 would be typical max */
<nPOD_component_type> ::=
'nGon' '(' <nGon_subtype> ')' |
'xPod' '(' <xPod_subtype> ')' |
<nGon_subtype> ::=
'nREC' = standard rectangular prism
'nCube' = standard cube
null = unspecified
'3' = triangular prism
'4' = rectangular prism with dimensions other than those of standard nCube or nRec
'5' = pentagonal component
'6' = hexagonal component
'8' = OctaPod, octagonal component
'ROC' = great Rhombicuboctahedron component
'TET' = tetrahedron with standard dimensions (to fit with nCube and nRec assemblies)
[other nGon subtypes are expected to evolve in the near future]
<xPod_subtype> :=
'APod' |
'CPod' |
'RPod' |
'TPod'

<face_id> ::= <base_id> | <top_id> | <side_id>
<base_id> ::= 0
<top_id> ::= 256

<side_id> ::= 1 | 2 | … | 255 /* in actuality, rarely will face_id > 8 */
<ent_loc_set> ::= '{' <ent_loc> (',' < ent_loc >)* '}'
<ent_loc> ::= '(' <xyz_coord> ','? <ent_id> ')'
<xyz_coord > ::= '(' <g_coord>,<g_coord>,<g_coord> ')' |
'(' <g_coord>,<g_coord> ')' /* (,x,y) has z implied = 1 */
<g_coord ::= 1 | 2 | … | 10
<ent_id> ::= <atomic_symbol> /* basically an alphanumeric string */
<position-orientation_set> ::= '{' <position>? ('.' <orientation>)? '}'
<position> ::= 'V' | 'H' | 'N' /* V = vertical, H = horizontal, N = non-aligned or unaligned */
<orientation> ::= 'N' | 'NE' | 'E' | 'SE' | 'S' | 'SW' | 'W' | 'NW' /* if unspecified, it does not matter */
<specification-attribute_set> ::= '{' <sa_expr> (',' <sa_expr>)* '}'
<constraint-discriminator_set> ::= '{' <cd_expr> (',' <cd_expr>)* '}'
<sa_expr> ::= <atomic_symbol> | '(' <sa_expr> '.' <sa_expr> ')' | <list>
<list> ::= '(' <sa_expr>* ')'
<atomic_symbol> ::= <letter> <atom_part>
<atom_part> ::= empty | <letter> <atom_part> | <digit> <atom_part>
<letter> ::= "a" | "b" | " ..." | "z"
<digit> ::= "1" | "2" | " ..." | "9"

Note:
Position-orientation set, Specification-attribute set, and Constraint-discriminator set are for more detailed specifications that may not be employed in early versions of nPODs or PodAtriums. Not all details of the nDLS have been defined and the nDLS is in fact created in such a manner as to be highly flexible, open-ended, and capable of easy revision.

As an EBNF expression for the full nDLS, we have:
<DLS-expression> ::=
<nPOD_id> '.' <nPOD_component_id> ('.' <nPOD-seq-loc>)? '.' <nPOD_component_type> '.'
<face_id> '.' <ent_loc_set> '.' <position-orientation_set> '.' <specification_attribute_set> '.'
<constraint_discriminator_set>

Examples: [Note = these need to be reviewed and edited since they are from back in April, 2013]
[nPOD identifier] = "BSL-PodAtrium" or "StarGateAlpha" or "nPOD_SGA"
[nPOD component] = 0 or 1 or … 8
[nPOD component type] = OctaPod or nCube or nGon(ROC)
SGA.0.OctaPod = the central OctaPod for the SGA
SGA.3 = the third arm of the SGA, which is either an nPOD component (if exists) or NULL (if not occupied or built)
SGA.1.1.nCube = the 1st arm of the SGA, an nCube, in the 1st position
SGA.5.NULL = empty location for the 5th arm of the SGA – note: the sequence locator can be omitted

SGA.7.APOD = hypothetical APOD serving as the 1st and only component in the 7th arm position of the SGA (thus the sequence locator is omitted)
SGA.8.3.nGon(ROC) = hypothetical ROC nGon serving as 3rd-sequence component in the 8th arm position of the SGA
SGA.5.2.nCube.4 = face 4 of an nCube in the 2nd sequence position of the 5th arm of the SGA
SGA.5.nCube.0 = the floor (face 0) of a solitary (1st and only) nCube in the 5th arm of the SGA
SGA.5.nCube.4 = the ceiling (face 256) of a solitary (1st and only) nCube in the 5th arm of the SGA
SGA.5.nCube.4.{ ((4,4,0), pcr-lab-system-3205) } = the PCR lab system that is labeled 3205, positioned with its main connection at xyz coordinates (4, 4, 0), thus flush with the wall, on face surface 4 of the single nCube that is in the 5th arm of the SGA
and so on and so forth – the general idea of the syntax and reading of DLS expressions should be clear from the definitions above.

nPOD Design and Operations Control System Information Management (nDOCSIM)

nDOCSIM is a web-based, mobile-accessible database and expert system for use in specifying, designing, ordering and organizing parts for, shipping and transporting, and operating an nPOD. This system is used by the TetraDyn team responsible for the given nPOD project before, during, and after fabrication. This system is also used, in a limited fashion, by any customer/client purchaser or lease-holder of an nPOD. nDOCSIM makes extensive use of the nDLS and there is strict code enforcement for nDLS program correctness. This strict control applies to all aspects of nPOD design, specification, fabrication, operation, and includes all aspects of reconfiguration including disassembly, transport, replacement of components, elements and onboard equipment, and reassembly.

For instance, it is not possible to assign two incompatible devices or objects to a specific location, either at the entity, element, or component levels. As an example, consider if a given nPOD has within its nDLS the following:

SGA.5.2.nCube.4.{ ((4,4,0), pcr-lab-system-3205) } which pertains to the (4,4,0) location on the 4th face of the 2nd nCube within the 5th arm of the nPOD denoted by “SGA”.

One cannot proceed in design or reconfiguration with an assignment such as

SGA.5.2.nCube.4.{ ((4,4,0), gcms-analyzer-2380) } since one cannot have two such instruments in the same location.

This would cause an error within the nDOCSIM and the design engineer would be notified, in order to resolve the issue.

Presently, nDOCSIM is implemented in nPL, version 1.0, which incorporates a large set of PHP scripts that operate with an SQL database, portable to MySQL or Postgres, plus various HTML and Javascript code. This is embedded within a Joomla web portal that allows for user community project workflow and schedule management, dialogs, articles, blogs, notes, maps, image and video galleries, and other standard features.

nPOD Programming Language (nPL)
nPL is a formal programming language for the design, assembly and operation of nPod systems. It is a functional language and is currently script-based. In nPL one can express different functions and procedures to be executed by either humans or robots, either computationally or physically, pertaining to nPods and the various devices and equipment that are incorporated with(in) nPods. nPL is designed to allow for easy and efficient expression of algorithms and methods of work, and many of these are not intended for automated processing on a computer but for sequential/parallel physical activity. nPL enables clear and concise expression and the power of rule-checking.

The heart of nPL is the nDLS and the heart of the nDOCSIM is nPL. Essentially, nPL offers a set of scripts for manipulating different expressions within the nDLS and enabling the nDOCSIM to operate.

Elementary operations for nPods and their elements are provided within nPL, but many physical as well as informational operations are implicit and must remain for the assembler/operator to define and to execute:

ConnectP (nPod1, nPod2)
nPod1 and nPod2 are both described by:

> [nPOD identifier].[nPOD component identifier].[nPOD sequence location].[nPOD component type].[Face identifier]

DisConnectP (nPod1, nPod2)
Inverse of Connect. Separate them.

Join (SE, SE-list)
Attach the structural element (SE) to one or more other SE's that are given in the SE-list. Necessarily or optimally, the joining operations will proceed in the order in which different SE's are listed within the SE-list.

UnJoin (SE, SE-list)
Inverse of Join. Take it apart.

Position (nPod, xyz-coord-set)
Line up the specified nPod at a particular position using (0,0,0) of the nPod and the values in the xyz-coord-set.

Long, long ways to go… Lots of revisions to the old version which is not shown here.

Appendix 1

All of the following is cut-and-paste from other documents, mostly the SGA specs of late-March, 2013.

SGA Functions ***[some are specific to SGA]***

Within phase 1, the following primary functions will be provided by SGA:

- Fab-Lab with instruments for plastic and metal fabrication. At nearby Manistee Rainbow, an arts and crafts enterprise, a full-service professional woodworking and metalwork shop will provide additional functions for the SGA as it is a unique and "special-case" installation.
- Hydroponic agriculture, with an nCube greenhouse. Options for the future include implementation and demonstration of a subsurface (underground) hydroponic greenhouse and the simulation of a remote, physically isolated agricultural facility as a simulation of space-based (orbital, lunar or exoplanetary) facilities. The long-term potential for SGA includes use as a successor to previous "Biosphere" experimental installations, which can include trerrestrial simulation of sustained human and animal residence and experiments in living within a MOSES-type PodAtrium for near-earth or deep-space locations.
- CRAIDO [3] biotesting for selected pathogens linked with infectious diseases affecting humans, including pathogens transmissible in food and water. The SGA is projected as being ready for viable public health operations serving (minimally) the eight-county region of NW Michigan for expected influenza or SARS-type epidemics or pandemics by 2014.
- *AlterNet* telecommunications – alternative, hybrid, fault-tolerant high-speed broadband internet and voice communications, focused upon rural areas with disadvantaged commercial telecoms and emergency situations (e.g., power outages, storm damage, or EMP).

See Figures 9 through 12 for illustrations of these functions.

SGA Operations ***[some are specific to SGA]***

SGA will enable demonstrations of rapid assembly and disassembly of all basic nPOD components including the relocation and reconnection of nCubes within the SGA. Once the basic SGA is assembled, all fabrication of nPOD component elements such as PFS elements will be conducted within or nearby the SGA, both indoors and outdoors. Wherever possible, fabrication and finishing work for the SGA will be performed within the SGA using only equipment that is part of or resident in the SGA, thus further demonstrating "self-replicating assembly" as well as self-sustainability principles of engineering. SGA equipment for demonstration, education and community use will include a variety of all equipment and instrumentation including but not limited to:

[3] CRAIDO = Community RApid-Response to Infectious Disease Outbreaks; initially designed as a highly mobile TPOD system, this can be in an nCube that is easily transportable by land, air or sea as an intact, complete unit or as a disassembled and reconfigurable system. The focus of CRAIDO is upon influenza, TB, cholera, yellow fever, salmonella, e.coli, West Nile Virus, Hanta Virus and dengue.

- energy generation by hybrid solar, wind, external combustion, hydrogen fuel-cell and other technologies (including simulations of certain additional types such as RTG and geothermal)
- full-service telecommunications including ARES and RACES radio operations
- emergency fabrication and machining in wood, metal and other selected materials
- biomedical sample testing for selective microorganism pathogens, parasites and toxic chemicals
- water purification for drinking-quality water supplies
- hydroponic agriculture conducted in nPODs and monitored for "CBRN" quality control by instrumentation within other nPODs within the SGA.
- simulation of the MOSES and ASTRIC space-based systems using a prototype assembly constructed within the SGA by students and advisors.

Almost everything stated from here on, in terms of SGA, also applies to BSLP.

SGA Public Use and Component Transport

When any part of the SGA is requested for use in the community, such as for a large public event or because of an emergency such as a storm, flood, fire, earthquake or other disaster, then the specific SGA component will be transported, typically by flat-bed truck or a towed trailer (optionally by helicopter or boat), manned by qualified personnel, and used under licensed permission and/or contract for the specified purposes. In many cases, this operation will be conducted with the engagement of one or more members of the SGA Crew, namely, members of the ECONADUNA or TetraDyn staffs. SGA is designed to also accommodate component transport (as in-situ nCubes or as disassembled array sets of elements) by water (via the Manistee River) or by air (via helicopter); however, for all practical purposes, within the initial Michigan site, any transport will most likely be accomplished by truck.

Most operations of the SGA will be conducted with real-time broadcast of activities via webcam for online viewing. It is the aim of the Organization to maintain maximal public visibility for the purposes of educating the complete public – individuals, families, schools, agencies, companies – of all the meritorious points regarding nPODs, PodAtriums, and the various systems that are implemented using different technologies in conjunction with these structures (e.g., CUBIT for public health biosensing, biotesting, and bioprotection). This procedure will provide for dissemination, education, cooperative R&D, promotion of technology and methodology, and also for validation of the proper and optimal use of funding, volunteer activities and other support given by institutions and individuals.

SGA Functions and Equipment Provisions (Phase 1)

The following will be provided within the SGA, Phase 1. The indicated locations are within the specific components (nCube and central OctaPod), as per the design and layout schema described above.

[1] Water analysis, purification and distribution – SGA.7.nCube
Portaqua Cube (qty 1)
Bagua supply (qty multiple)
Timberline purifier supply (qty multiple)

[2] Public health and Food quality control – SGA.4.nCube
Biolumin and SWIPE sensor kits (qty multiple)
Veredus system (qty 1)
Immunoassay system (qty 1)

[3] Energy and Power – SGA.7.nCube
Solar panels (qty 4)
Fuel cell system (qty 1)
Tornado (Cyclone) Engine-Generator (qty 1)
Gas or diesel generators (qty 1)
Cylindrical VAWT wind generators (qty 4)
(optional situations) Compact nuclear power cell (RTG)
Converters and Batteries (qty multiple)

[4] Air-liquid-solids analysis – SGA.6.nCube
Portable GC/MSD (qty 1)
XRF (qty 1)
FTIR (qty 1)

[5] Communications Module – SGA.0
Satellite internet interface (qty 1)
MANET Kit (qty 1)
Radio communications master module (qty 1)
Server (qty 1)
Laptops (qty 2)
Tablets (qty 2)
Phones (qty 8)
Router-modem (qty 1)
(optional) Large public display screen (@ 50”) (qty 1)

[6] Food Preparation Module (not for the SGA, phase 1)
Meat preparation kit
Refrigeration unit
Meal preparation kit

Multi-fuel stove and oven module (gas burners, electric burners, microwave-convection oven, gas/electric oven)

[7] Emergency Medical module (not for the SGA, phase 1)
(pre-existing standardized kits)

[8] Chronic Care Medical module (not for the SGA, phase 1)
(standard and novel assisted motion and manipulation devices)

[9] Shelter module (not for the SGA, phase 1)
Two (?more) rapid-deployment air-inflated shelters
Tentrad kits (4)
Space-blanket packages (48)

[10] Tools module – SGA.0
Fabrication and repair set of tools and parts
Wood-cutting kit (chain saw and accessories, saws, axes, mawl, wedges)
General-purpose tool kits (e.g., B&D, full suite, portable/rechargeable-battery package)
Möljner Tools (8)

[11] Psychosocial Care module (not for the SGA, phase 1)
Counseling space module with furnishings and audio-visual accessories

[12] Bioprot and Hygiene module – SGA.4.nCube
BioProt solutions for surfaces and textiles
Biopaper supply
"Blue Phenol " testing kit for BioProt longevity testing

SGA Component Dimensional Specifications - *these are NOT for the BSLP*
nCubes (all) are of the same type. Each face element is 3m x 3m. Door frames are 200cm high x 80cm wide, positioned center or off-center relative to the face (at the discretion of the structural engineer (SE)). Stairwell/ladder openings are 60cm diameter, positioned at discretion of the SE. Window frames are at each side of the doorways, dimensions and precise positions to be at the discretion of the SE. Figure 9 illustrates some SGA face elements using PFS architectures.

SCP connector modules are illustrated in Figure 10 and these are placed at approx. 1.5m elevations on faces 1, 2, 3, and 4 of each nCube, allowing for match-up fittings when nCubes are joined in the standard practice: face 1 of nCube A to face 3 of nCube B, or face 2 of nCube A to face 4 of nCube B, etc.

Alternatively, there could be two SCP connector modules on each face, one on each side.

OctaPod dimensions: 3m high, each edge 3m wide. This provides for a uniform simple octagon with side faces that are 3m x 3m, suitable for complete line-ups with nCubes or similar-faced nPOD components that are other than nCubes. The base and top surfaces of the OctaPod have two detachable, removable hatchways – one is a standard 60cm diameter channelway for a ladder or spiral stairwell, and the other is a 1m x 1m square hatchway suitable for larger equipment (movement or collocation spanning multiple OctaPods or an OctaPod with another type of nCube component above or below it. The precise positioning of these two openings is at the discretion of the SE.

Additional special “hub” type nGons may be constructed, similar to the OctaPod, for use in PodAtriums. The DodecaPod is referenced in Figures 1-A thru 1-D; this is very suitable for certain applications such as for medical, agricultural or industrial applications where a larger central hub unit can be more appropriate due to heavier human traffic, additional centralized equipment and functions, and the value of having separate entrances to the central hub unit that are not through the adjoining, attached nPods.

Technical Appendix

The following serves as a glossary of technical terms.

Atrium

Atrium-Cap

BE (Base-Element)

Component (in context of nPods and PodAtriums)

FE (Function-Element)
A specific piece of equipment, furniture, instrumentation or supply that has an assigned set of 1 or more functions and an assigned (but possibly movable) location within a specific nPod.

JE (Joiner-Element)
Couplers and insert-sleeves for joining two or more BE.

nPod – a structure designed to be a generic building-block of more complex structures for different uses and characterized by being compact, standardized in design and materials, and easy to assemble and disassemble. The two main types of nPod are the nGon and the xPod.

- nGon – multi-sided…
- xPod – special types that are based upon other existing products

The four main subtypes of nGon are:

- nCube – a cubical type of nPod (*type* nGon); the standard is 2.5m x 2.5m x 2.5m
- nRec – a rectangular-prism type of nPod (*type* nGon); the standard is 2.5m (w) x 2.5m (h) x 4.0m (l)
- ROC – great rhombicuboctahedron…
- TET – tetrahedron…

The four main subtypes of xPod are:

- APOD – xxxx
- CPOD – xxxx
- RPOD – xxxx
- TPOD – xxxx

PodAtrium – a multi-nPod structure that is characterized by multiple “arms” formed by adjoining and interlocked nPods and with at least one intersection-node that may be n-sided (but typically 4- or 8-sided) that constitutes a room linking two or more such “arms”

SE (Structural Element) – a unit-part of an nPod that is assembled from multiple BE and JE units.

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END NOTES

[1]

ECOADUNA is a non-profit 501c(3)* private foundation for research and education in STEMA (science, technology, engineering, mathematics and arts) fields, encompassing the Institute for Innovative Study (IIS), EcoSymbio Economic Park (ESEP), Ex Terra Ad Astra (ETA), and The Academy (ACAD):

ESEP – A commercial business incubator enterprise fostering private for-profit businesses and coalitions that share common and mutually synergetic objectives and business activities pertaining to energy, environment, health and security. Members include TetraDyn Ltd. and its portfolio of companies.

IIS – A basic and theoretical research center in the physical, biological and psychosocial sciences, focused upon quantum relativistic physics, exploratory energy generation and propulsion, epigenetic and synthetic biology, wholistic medicine and agriculture, and psychosocial dynamics; the IIS fosters individual and team projects, research retreats, seminars, workshops and conferences.

ACAD – An onsite, hands-on, and online, distance-based learning institution offering diversified programs for youth and adults of all ages, based upon the classical Platonic and Aristotelian Academy, with a focus upon STEMA themes and activities including Ars Bio, Fab-Lab, and participation in courses and seminars ranging from the arts and crafts to space-based engineering and systems design.

ETA – An applied research and engineering initiative focused upon practical, near-term, economically feasible and socially necessary programs in space exploration and development including ASTRIC (asteroid reconnaissance, intervention and countermeasures), based upon MOSES (modular organic-assembly space-based engineering systems) and implemented using nCube, ROC and PodAtrium technologies.

(* IRS application underway 2013)

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TetraDyn Ltd. is an engineering and technology company that operates as a direct provider of technology products and services and as the parent and principal holding-company with interests in a portfolio (group) of closely-related private small-business firms. These constitute The TetraDyn Group and include, at present (March, 2013), along with TetraDyn Ltd., a portfolio of privately owned and managed small businesses with mutually beneficial and complementary products and services include:

AIDA (mobile apps and web portal services for lifestyle, health, emergency response, energy management and other applications)

ASIM (modular, mobile Pod structures and compact, modular analytics)

CUBIT (community public health biotesting systems and services and the BioTetrad diagnostic technology)

EcOasis (innovative home and health products)

ELS (innovative personal/community health and safety products)

Kyberos (ultra-secure data bank and trust services)

NomadEyes (civilian community-based safety and security information network)

Orbis (ecosymbiotic community and neighborhood design and systems integration)

Thera (hybrid energy systems)

Closely related as a partner is **Manistee Power Tool and Craft** (custom and specialty woodwork, metalwork, machining, smithing, glass, textiles, and fine arts; operator of the commercial and retail services for visitors at the "Rainbow" site along the Manistee River.)

TetraDyn Ltd. is a member of the EcoSymbio Economic Park (ESEP) that is a development initiated and sponsored by ECOADUNA Foundation.

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