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C O S M I C   P C   W I S D O M

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Computerized

Operational

System

Modelling for

Integrated

Control

Using Personal Computers For

Workable and

Intelligent

System

Development,

Operation, and

Maintenance

Third Edition

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CONTENTS

A. INTRODUCTION

The paper is written for five purposes. It is intended to serve as:

1. Small Business Innovation Research, SBIR, Proposal. It was first written as a proposal under the SBIR program; format follows such proposals.
2. Unsolicited Proposal. It serves as an unsolicited proposal.
3. Client Brochure. It also describes work that may be done for clients.
4. Textbook. It serves as a textbook for a continuing education course.
5. General Publication. A guide for those who wish to use COSMIC modelling.

B. ABSTRACT

1. Need for Better Planning. General Eisenhower is quoted as saying,

"Plans are not important - planning is!"

The budget deficit for the nation is approximately the same as the reported losses to unplanned events, that is, mishaps. Persons attempt to deal with very complex, dynamic, high-risk systems in ways that are insufficient for adequately understanding these systems. The underlying root causes for many mishaps are oversights and inadequate integration due to conflicts between specialized requirements that then result in poor visibility of physical and human limits, combined with overly-optimistic control.
This is exacerbated by the proliferation of unique, uncommunicative software.

2. COSMIC Models for Planning. The Principal Investigator's, P.I.'s, background of 35 years in system safety engineering and management, working with and consulting on well over a thousand high-risk development projects, indicates that several chronic problem areas observed in defense aerospace research and development work may be ameliorated through use of COSMIC modelling. COSMIC modelling may aid in personal comprehension of complex systems as an aid in planning and controlling. COSMIC modelling is pervasive technology for describing risks by dynamic interactive modelling with embedded calculations using off-the-shelf personal computer, PC, software. COSMIC uses spreadsheet diagrams for creating a matrix of elements and activities.
(The accompanying diskette contains sample COSMICs and database files.)

a. Scope. Safety Analysis Systems, SAS, proposes to assist in development of user-maintainable COSMIC models using generic user-provided PC software. SAS will act as System Operator for networking between COSMIC users.

b. Application. COSMIC is particularly suitable for the class of high-risk management between simple systems that may be managed through experience and rote memory and those involving specialized mainframes and operators. COSMIC models are conceived of being made of up to a thousand inter-related events that are described with quantitative formulae. By using selected aggregated and distribution, COSMIC models may be linked to encompass systems on the order of several million events f or a wide range of applications.

c. Total Quality Management, TQM. COSMIC is particularly useful where an interdisciplinary and/or inter-organizational system requires a moderate degree of integration, cooperation, and teamwork. COSMIC models are developed through a team approach similar to quality circles or TQM Teams. The process encourages identification of team members as eight personality types and matches them to steps in a structured problem-solving and planning process, thereby doubling efficiency as compared to solving by any one person.

3. SHERDQAM. (Rhymes with "SURE CAN".) Since most management is concerned with planning the actions to avoid losses, that is, safety management, this is treated first. The initial application is with a Safety, Health, Environmental, Reliability, Decision, and Quality Analysis Model, "SHERDQAM".

C. IDENTIFICATION AND SIGNIFICANCE OF PROBLEM/OPPORTUNITY

1. COSMIC as Pervasive Solution and Opportunity. The pervasive COSMIC technology may be characterized as both a partial solution to recurring problems and an opportunity to develop innovative new technologies. The use for decision-making is again emphasized by the dictum that

"Data becomes information only when it is used for making a decision."

A common problem in developing new technology is that no models exist for describing either the current technology nor the improvements to be gained by adopting the new technology, particularly as regards risk.

2. Many Diverse Specialties Lead to Duplication, Conflict, and Isolation. Experience shows that specialized disciplines rely on manual techniques or unique computer programs to solve problems. This resulted in fragmented information often lacking in promptness. As an example, an Air Force Base Wing Commander found that his responsibilities, written by myriads of independent specialists and collected by his staff, resulted in a print-out of one-line statements three inches thick! Top managers may appreciate the visibility and flexibility that might be provided by a desk-top or laptop PC COSMIC. It would seem reasonable to assume that much of the paperwork could be reduced by having a common source of information for the various people, disciplines, and functions involved, an environmental improvement in itself.

3. Integrated Control. Clearly, one desires minimum duplication and maximum integration, especially where common goals and purposes prevail, such as controlling risk of unplanned losses in areas of: safety; occupational health; chemical hygiene; civil engineering; weather forecasting; environmental protection; pollution prevention; fire protection; system security; emergency response; disaster preparedness; traffic safety; trauma treatment; drug control; bioenvironmental engineering; reliability; and quality. Similarly, many complex systems that have the advantage of models of their systems depend upon smaller subsystems that lack such advantages.

4. Modern PCs Present Opportunities. The continuing growth in capability now available with the common personal computer, PC, calls for a review of its use. Its main feature is the ability to augment the individual mind where the scope of thinking exceeds human capabilities for managing high-risk operational systems. A potential benefit of this proposal would be a system model that might be used generically for other similar systems. A single integrated COSMIC might be developed and used by each and all of the activities mentioned above. New technologies may have COSMICs developed concurrently to shorten the time required for adoption. Operational Subsystem managers may use COSMICs as a relatively simple, common method of describing their subsystems as modules to be incorporated into larger systems. This could be done without resorting to unique software or specialists. Schedule needs for integration could be shortened, particularly for controlling risks.

5. Significance. The significance of the problem is seen particularly in the continually escalating costs of unplanned losses. The budget deficit for the nation is approximately the same as the reported losses to mishaps. One need only recall the notorious headlines, which will not be repeated, to appreciate the significance of the problem and the need for improving the ability to control losses. The significance of the opportunity may be seen in reducing oversights, improving technical performance, and improving teamwork.

D. TECHNICAL OBJECTIVES

1. General Objectives. The general objective for this proposal is to find out how practical COSMIC is as a tool for the users. Special note will be made of the benefits and shortfalls of developing and using COSMIC, versus other intended methods. Findings revealed through the development and use of the model, particularly as regards describing decisions and system changes will also be noted. An objective is to create polyphony out of chaos, i.e., "E PLURIBUS UNUM".

2. Specific Objectives. Since the assurance of optimum loss and litigation is seen as an important driver for the system effectiveness, the technical objective is attaining the user's required assurance, with SHERDQAM models.

a. COSMIC should be practical for users in an on-going development.

b. SHERDQAM should be capable of showing the significant risks of the operational system and accepting, calculating, and showing changes.

c. Further specific objectives are detailed as follows.

*** Life Cycle Management - concept through re-use.**
*** Includes total system and human resources.**
*** Optimize with cost, schedule, effectiveness.**

Plate 1 - System Program Management

3. Systems Program Management. See Plate 1. Systems Management, as explained by von Bartalanffy in GENERAL SYSTEMS THEORY, is the starting point for COSMIC. The emphasis of high-risk weapon systems engineering, as implemented by Gen. Bernard Schriever, was on integration and optimization throughout the system service life cycle, including all elements, subsystems, and segments.

*** Minimize unplanned loss, damage, injury.**
*** Includes occupational health, environmental safety.**
*** System Safety Group, SSG, ensures all are involved.**

Plate 2 - System Safety Program

4. System Safety Program. See Plate 2. The requirements were defined in Military Standard MIL-STD-882 some 20 years ago. The main goal of system safety management is the optimum level of safety. The DOD/DOE/DOT/NASA standard for precluding unplanned losses is the system safety program, which formalizes the assurance process. The process has also been widely adopted by many defense and power and communications industries world-wide.

The Standard requires a System Safety Group, SSG, composed of representatives for all concerned, to ensure that omissions and oversights were minimized and communication maximized. The SSGs served as Quality Circles and TQM Teams.

- **Program Plan**
- **Hazard Analysis Reports**
- **Health Hazard Reports**
- **Change Analysis Reports**
- **Progress Reports**
- **Safety Assessment Reports**
- **Mishap Analysis Reports**
- **Explosives Classification**

Plate 3 - System Safety Data

5. System Safety Data. See Plate 3.

a. Program Directors ensure that the information is acquired in a timely manner by specifying development of the reports shown. Emphasis is placed on historal data to use lessons learned.

1. System/Subsystem/Comp: Maintenance hangar or vehicle garage.
2/3. Comp/Subs Fail Mode : Fail to contain fumes and ignition sources.
4/5. Sys/Comp/Event/Phase: Operational, maintenance, or storage.
6. Operation Description: Vehicle operating or being maintained/stored.
7. Hazard Description : Sparks and fumes leaking from tanks/HAZMATs.
8. Hazard Identification: Only if leaks large enough to smell or see.
9. Effects of Hazards : FIRE. Loss of vehicle and garage; injury.
10. Risk Assessment : $100,000; "Occasional". Risk Index 1-C.
11. Recommended Actions : Fume/fire detect/suppress; or seal HAZMAT/fuel
12. Effect of Actions : $5,000 installation; procedures.
13. Remarks: Doc,Dat,Dir : Manufacturer estimate. NSC ACCIDENT FACTS.
14. Status: Dwg,Spec,Pro : OPEN pending safe completion of testing.
15. Note, Caution, Warn : Warnings in HAZMAT handling/storage procedures.
Chemical Identity: ______________________ P.E.L.: ________ T.L.V.: ____
NIIN: _________ P/N: __________ QTY: ____ MFR: ________________________
Medical Exam: _ Personal Protective Equipment: _ Air Permit: _________
MIL-STD-882 Risk Index is 1-C; with corrective actions, 1-E.
Radiation Type: abcdefg Power: 12345 Minimum Distance: 12345

Probabilistic Risk Analysis (ANNUAL ~$K)

FACTOR:	BUDGET:	HAZARD:	ACTION:	CUMULATIVE:
Probability	0.99	0.01	0.99	0.98
Mishap/Action	1000	120	5	115
Operation/Maintenance	20	200	5	15
Medical/Legal	400	300	1	29
Time/Schedule	1000	500	2	990
PROBABLE TOTAL _______	1158	11	13	1126
Life Cycle Cost @ 6%, 20 years._________		120	30	

Plate 4 - Hazard Analysis Report.

b. Hazard Analysis Reports. See Plate 4. These are iterated throughout the program in phases: preliminary; system and subsystem; and operational and support. The plate displays a database printout of the items for a common hazard as rows of data. Note that it includes Annual Risk and Life Cycle Cost. Budget and Cumulative are discussed later.

*** Difficult to describe complex chains of events.**

*** Difficult to relate interfaces between elements.**

*** Difficult to describe and optimize the total system.**

Plate 5 - Hazard Analysis Report Problems

c. Hazard Analysis Report Problems. See Plate 5. There are several problems with the standard hazard analysis report required by MIL-STD-882.

d. Operating Hazard Analysis. Another format used in the operational and support phases is based on columns and rows in landscape format. This format, known historically as an Operating Hazard Analysis, OHA, places Items 1 through 5 as rows and Items 6 through 16 as columns.

6. Fault Tree System Analysis. Noting the problems described in Plate 5, safety professionals sought better ways to cope with problems.

a. System. The "main claim to fame" in the system safety engineering is the so-called "fault tree", a diagram which details the various causes that may lead to a mishap. It was derived from Bell Telephone Laboratory's work in network analysis used in ICBM guidance systems about 30 years ago.

The diagram is drawn as a vertical flow-chart with the main fault at the top and various blocks and paths with symbols linking together so it looks like a Christmas tree. The essence is control theory, rather than breakage.

b. Process. The key process in developing fault trees is the tracing of the flows of control signals and power. As Dave Hassel has taught thousands of system safety engineers at short courses with the University of Washington,

> "No matter where you begin analyzing a system, if you trace the signal and power, you will ultimately end by defining the whole system."

c. Problems. Due to a heavy reliance on manual methods and/or unique software programs, there is no standardized method of documenting fault trees nor library of them; therefore, there is no interchangeability. Fault trees are foreign to the layperson who must interpret them. The vertical arrangement is different from horizontal charts used by management; information cannot be readily transferred to other conventional systems. They are not very useful for explaining to laypersons, as in public relations or litigation.

7. Examples of Partial Usages. Five case examples illustrate COSMIC's value.

a. A fault tree was developed for a weapon system. The complete tree was displayed in a hallway. Many of the project people consulted the tree, since, as one observer remarked, "It's the only way to see the whole system!" The program also used color-coded flowcharts by ARINC for trouble-shooting.

b. The P.I. displayed a fault tree of the flight control system of a robotic intelligence-gathering vehicle. The program manager asked if it could be used for reliability analysis - it could be and was modified. (Note that the MIL-STD-785 on Reliability requires that, where there is a man-machine interface, the analyst assumes that the human is error-free.) The P.I. wrote the Safety Plan for the Wright Laboratory requiring that the analyst assume a 1% error rate, based on Air Force maintenance studies.)

c. An organization's hundreds of contracts experienced delays of half a year. As a TQM matter, the process was analyzed and a flow diagram was developed. The 25-foot long diagram was also displayed in the hallway to show the lengthy process. Several weeks were cut from the schedule.

d. The first flight of a chemical laser involved several operators, the laser, the ventilation and suppression system, and the aircraft. The P.I. flow-charted 59 steps in the emergency procedures; the test was successful.

e. The final example involved tracing the actions in the acquisition, use, and disposal of HAZMATs; the process involved about 20 organizations.

```
 COL>   A            B         C     D     E   F     G    H       I    J
_____________________________________v____________________v____________v____
ROW                                  v                    v            v
VV  +-------------+      +--------------+                 v            v
 3  | Personnel    >---->  Absent   .75  >------------------------\    v
 4  +-------------+      +--------------+                 v       |    v
 5                                                        v       |    v
 6  +-------------+      +--------------+                 v       |    v
 7  | Vehicle fuel >---->  Leaking  .05  >                v       |    v
 8  +-------------+      +--------------+ \       +-----------+   v 0.00375
 9                                         \    >  Fumes  .10 >->AND> FIRE
10  +-------------+      +--------------+   >OR<  +-----------+   ^
11  |HAZMAT/WASTE  >---->  Leaking  .05  >>/    >   POLLUTION |   |
12  +-------------+      +--------------+         +-----------+   |
13                                                                |
14  +-------------+      +--------------+         +-----------+   |
15  | Electrical   >---->  Exposed  .05  >-------> Igniter .05 >-/
16  +-------------+      +--------------+         +-----------+
```

Column A boxes are called Basic Object Blocks, or BOBs.
Columns C-D and Columns G-H boxes are Numerical Object Blocks, NOBs.
The formula for cell H8 calculates the joint probability of cells D7 OR D11 as 0.05 + 0.05 = 0.10. The result in cell J8 is the joint probability of cells D3 AND H9 AND H15 as 0.75 * 0.10 * 0.05 = 0.00375.
Sealing the HAZMATs would give a safety level of 0.99, given human error.
The probability of pollution is likewise improved from 0.10 to 0.01.

Plate 6 - Spreadsheet Fault Tree

8. Spreadsheets for Fault Trees. See Plate 6. The use of spreadsheets in finance has been expanded to include useful functions as "smart" flow charts. The added advantage over conventional flowcharts is that the numerical calculations may be also incorporated into the spreadsheet and recalculated in simulation. The rows are used for elements such as: subsystems; organizations; and cost centers, including the interfaces between them that are systems in their own right. Referring to Plate 5, Items 1, 2, and 3 are entered in rows as elements, Items 4 and 5 in columns as event phases.

9. Fault Trees with Subsystem Hazards and Reliability. As descriptions of systems, fault trees are usually "stand-alone" items, meaningful only to a small group of specialists. Another form of system safety analysis, the Subsystem Analysis, is similar to the Reliability Failure Modes and Effects Analysis in that each function is analyzed in detail. These two analyses may be readily written into spreadsheet flow diagrams. Both safety, including occupational health and environmental protection, and reliability are thus performed with the same effort, avoiding duplication. Human factors are included for safety, health, environmental, and reliability training.

*** Faults Are Traced Backwards to Human Decisions**

*** Decisions Are Traced Forwards to Success or Faults**

Plate 7 - Double - Tree

10. Fault Trees with Decision Trees. See Plate 7. Faults always stem from human errors made in decisions; recall the 1% error rate. In the operations area, decision trees have been used to show the various scenarios stemming from successive decisions. The two trees are combined in the "Double-Tree". The resulting diagram then shows both the consequences of the decisions and the causes of the losses in a single diagram that relates one to the another.

```
1. Flow of Events in Columns > > > > >
2. Elements
   in Rows                  / 4. Success Paths >  5. Success Trees
   V V V   3. Decision Trees <
   V                        \ 6. Fault Paths   >  7. Fault Trees
   2.a. Controller
   2.b. Controllee
```

Plate 8 - System Model Format

11. Double-Trees for System Models. See Plate 8. Defense systems are managed with considerations for Systems Engineering, prescribed in MIL-STD 499, and Configuration Management, as prescribed in MIL-STD 480. These standards define the arrangements and relationships of typical systems, subsystems, segments, and activities. Industry has similar guidelines. The Double-Tree may be expanded to include these tools. Three suggested guides follow.

a. Conventions. Two simple conventions clarify the arrangement.
   1.) Success paths are placed above fault paths;
   2.) Processes being controlled are placed below the items that perform controlling, in an hierarchical format.

b. Truncation. Users may determine an appropriate level for truncating the model. A typical cut-off might be the normal breakage expected, such as 1% - 2% per year, where costs for the model might exceed the actions being modelled.

```
                       +-----------------+         +------------------\        +----------\ +--------+
+------------+      /->   Present        >-----S->  Detect  fumes,    >-->OR> Ventilate  > Response|
| Personnel   >-- D<   +-----------------+         | sparks, intruder |  /    +----------/ _ Abated |
+------------+      \->   Not present     >-F-\    +------------------+  /                 +--------+
                       +-----------------+    \                          /
                       +----------------\     v                          /
+--------------+    /->  Vent/Drain Sys. >->->->->->->-S->->->->-AND->->-/
| Safety system > D<   +----------------<     v                /
+--------------+    \--> No System       >-F->AND->->-\        /
                       +----------------/             \        /
                                                      \        /
                       +-----------------+            \        S
+--------------+     /->    Fuel sealed   >S          \        /
| Vehicle fuel >- D<   +-----------------\            \        /
+--------------+     \->   Fuel leak/vent >-F-\       \        /                      +--------+
                       +-----------------/    \       \        /   +---------\    /->->-F->-> SPILL _|
                       +-----------------+    >OR->->->AND-OR<-->> Fumes/Liq.>OR<          _ INJURY_|
+--------------+     /->  HAZMAT sealed   >S  /                    +---------/    \         +--------+
| HAZMAT/WASTE >- D<   +-----------------\    /                                   \
+--------------+     \->  HAZMAT leak/vent>-F-/                                   \
                       +-----------------/                                        \
                                                                                  \
                       +-----------------+                                        >-AND>\
+------------+     /->  Electric sealed   >S                                      /     \
|Electrical Eq >- D<   +-----------------\                                        /     \
+------------+     \->  Electric spark    >-F->->\                                /     \
                       +-----------------/       \                                /     \
                                                 \                                /     \
+------------+         +-----------------+       \                 +---------\    /     \
| Natural     ³     /->  Grounding Rods   >S      >OR-- F>---------> Igniter  >->-/     \   +--------+
| Environment  >- D<   +-----------------\       /                 +---------/          >OR-> FIRE  _|
+------------+     \->  Lightning strike  >- F->-/                                      /   _DAMAGE _|
                       +-----------------/                                              /   +--------+
+------------+         +-----------------+                                              /
|  Social     \     /->  Security system  >S                                            /
| Environment  >--D<   +-----------------\                                              /
+------------+/     \-> Vandal+torch+fuel >- F >->->->->->->->->->->->->->->->->->->->->/
                       +-----------------/
```

Plate 9 Double-Tree of Vehicle Garage

12. Example of Preliminary Model. See Plate 9. The hazard discussed and illustrated in Plates 4 and 6 is illustrated showing that the scope may be expanded to include more objects (sans numbers for clarity):

a. the Decision paths, "D";

b. the Safety paths, "S"; and

c. the Fault paths, "F".

d. Notice that system security and environmental impact are included in the model. The system assumes inclusion of the ecosystem.

e. Notice that preliminary models require very little memory or calculations, although some effort must be spent in creating the model;

COST CENTER MANAGER SUBSYSTEM/EQUIPMENT	BEGIN BUDGET			PHASE ONE		Est.	Cum.
Executive Management	P=	0.75		Write in the	P=	.90	.90
and planning factors	M=	-1200	>	description of	M=	- 20	-1180
for actions on the	0=	2400		the success or	O=	+200	+2200
success roadmap.	S=	- 100		desired plan	S=	-100	0
	T=	- 300		to achieve	T=	- 20	- 280
" Plan A "	PT	600		objectives.	PT	+ 54	+ 666
Potential problems	P=	0.25		Write in the	P=	.10	.10
or alternative plans	M=	- 300	>	description of	M=	- 20	- 280
with actions on the	O=	0		the problem or	O=	0	0
alternative roadmap.	S=	- 200		hazard plan.	S=	- 50	- 150
	T=	- 100		(Continue flow	T=	- 10	- 90
" Plan B "	PT	- 150		right for fix)	PT	- 8	- 52
GROSS TOTAL	GT	450		GROSS TOTAL	GT	+ 46	+ 614

1.) Compare plans to attain the same objectives on the basis of the GTs.
2.) For prioritizing, rank decisions according to the differences in PTs
3.) The lower row may be extended to the right for the best hazard fix.
4.) The decision criteria may be included as factors under each element.
5.) " P= " is for the Probability entries (sum to 1 at GT).
6.) " M= " is for the Money or cost expenses (negative values).
7.) " O= " is for the Operational Effectiveness/prOfit/Output (positive values); For incremental events, consider revenue or value added.
8.) " S= " is for the Safety Social Readjustment Stress; See Holmes-Rahe.
9.) " T= " is for the Time or schedule costs (negative values).
10.) " PT= " is the product of the Probability and the sum of the Money, Operational effectiveness, Stress, and Time.
11.) " GT= " is the Gross Total of PTs for the event/phase.
12.) " Est " is the planning estimated data for the event.
13.) " Cum " is the cumulative running total, subtracted from budget.

Plate 10 - "MOST" Criteria.

13. "MOST" Criteria. See Plate 10. In order to include the decisions, criteria must be established for the decisions. This is shown with simple numerics to illustrate the decisions under risk. Common criteria are shown as "MOST" factors. Experience has shown these to be involved in most decision-making. Note that the Safety Stress is included for human factors that are often overlooked. Condensed models may use the PTs as in Plate 6 preliminary format.

* **Expand SSG to CCB to TQM Team Process**
* **Extend Double-Tree to Total System**
* **Include Quality Measures and Special Factors**

Plate 11 - TQM Team Process

14. TQM Team Process. See Plate 11. The Total Quality Management, TQM, practice is inherently aligned with the COSMIC in that the processes are addressed and the significant factors are addressed, along with the statistical process control, SPC. The Special Factors are extendable to include the measures of quality, especially as defined by the end user customer. The crucial improvement is the involvement of people and their processes. The teamwork of the System Safety Group and Environmental Protection Committee may be extended to the Double Tree Team, which is just a bit more than the usual Configuration Control Board, which may include the concept and members of the TQM Team.

```
                       To Customers >>>
     >         >          >          >           >>
    /         /          /          /           /
   /         /          /          /           /
====================== Team =========================>>
              /              /             /
             /              /             /
           >              >             >
             >>> From Suppliers
________________________________________________________

+---------\    +----------\             +-------------+
|Customers >>>>Requirements>\          >> Satisfaction |
+---------/    +----------/  \         / +-------------+
+---------\    +--------\     \ +-----\ /
|TQM Team  >->- Process  >->->-> Solve >/
+---------/    +--------/     / +-----/
+---------\    +----------\  /
|Suppliers >>>> Resources  >/
+---------/    +----------/
```

Plate 12 - Fishbone to COSMIC

15. Fishbone to COSMIC. See Plate 12. The well-known TQM fishbone is an excellent starting point for defining the process and the people and functions that are involved in the process. Simply converting the fishbone into a COSMIC might improve structuring the process and setting it up for including the other COSMIC capabilities described above.

16. Organizational Psychology. The SSG and CCB usually operate under some rules such as Robert's RULES OF ORDER. Some organizations go further and use structured problem-solving for planning. Since solving problems is inherent in continual improvement, a special feature is added to further improve the COSMIC process. The following summarizes the best from experience.

a. Maybe you've come across books such as THE QUADRANT SOLUTION, or A WHACK ON THE SIDE OF THE HEAD, or PLEASE UNDERSTAND ME. Maybe you've heard about "hemispheric specialization" or "lateral thinking" of de Bono, or "Janusian thinking", or the Meyers-Briggs Type Inventory, MBTI; they all refer to personality types and traits.

b. In THE T FACTOR: HOW TO UNDERSTAND TIME AND USE IT RIGHT!, Dr. Mark Stein explains how Jungian personality type influences how persons relate to time. He explains their traits:

1.) "feeling" f-type for spatial, living in the past;
2.) "intuitive" i-type for spatial, living in the future;
3.) "sensation" s-type for active, living in the present.
4.) "thinking" t-type for conceptualization, living in all three.

c. David Kolb and Min Basadur, in ORGANIZATIONAL PSYCHOLOGY, indicate:

1.) People have different styles of learning and solving problems;
2.) They seek and work best in occupations that use their styles;
3.) They avoid people and work that conflicts; and
4.) They can team together to be more effective.

1 **Spatial**	2 **Observing**	3 **Verbal**	4 **Active**
feel	**watch**	**think**	**do**
hunch	**listen**	**logical**	**work**
intuitive	**reserved**	**reasoning**	**trying**
open	**quiet**	**analytical**	**practicing**
accept	**look**	**rationalize**	**responsible**
receiving	**careful**	**conceptual**	**practical**

Plate 13 - Learning Styles

17. Learning Styles. Their instrument, the Learning Styles Inventory, uses only 12 questions to identify four learning styles. See Plate 13 for a simplified version. The words in each row are scored for relative preference: "4" for "most like me"; "1" for "least like me"; and so on. In MAPS OF THE MIND, Charles Hampden-Turner describes the theories of J. P. Guilford on creative performance and Jean Piaget on development of intelligence. Totals for the four columns are combined and plotted on a Guilford-Piaget grid (similar to the "World of Work" seen in academic career counselling):

a. Column 1 less Column 3 is plotted vertically; and

b. Column 2 less Column 4 is plotted horizontally.

The results determine problem-solving roles as follows:

1.) Divergers or Idea Generators ("DIGgers");
2.) Assimilators ("SIMmers");
3.) Convergers or Optimizers or Judges ("COJitators"); and
4.) Implementers or Accommodators ("WAIers").

```
                              SPATIAL
                               ( + )
                            ___________
      Warrior              /     |     \     Diverger
      Accommodator        /      >      \    Idea Generator
      Implementer        /   4   |   1   \    "DIGger"
      "WAIer"           /        |        \
                       |        / \        |
    ACTIVE     (-)     |---^---- C ---v----| (+) OBSERVING
                       |        \ /        |   Col.2 - Col.4
                        \        |        /      horizontal
                         \   3   |   2   /
                          \      <      /
       Converger           \_____|_____/     asSIMilator
       Optimizer              ( - )          Artist (?)
       Judge                 VERBAL          "SIMmers"
       "COJers"           Col.1 - Col.3
                            vertical
```

Plate 14 - Problem-Solving Team

18. Problem-Solving Team. See Plate 14. Kolb and Basadur build on these to create a structured problem-solving method.

a. It's one of those cases where the actual results pretty much go along with the theory. Decades of data collecting show that people do tend to work in occupations that use their favorite preferred styles.

1.) therapists, secretaries, systems engineers, retirees as DIGgers,
2.) scientists, technicians, bankers, inspectors as SIMmers;
3.) engineers, military, nurses, teachers as COJers;
4.) administrators, athletes, consultants, salespersons as WAIers;
5.) A Core sector is added by the P.I. for a "Coach" for the Team.

b. There are three choices of strategy given by Kolb and Basadur:

1.) develop supportive relationships, the easiest way;
2.) improve the match between style and life, more difficult; and
3.) become more flexible - learn the other styles.

c. The McBer Company of Boston markets the Kolb-Basadur techniques and other training, doing organizational development exercises using 1.) above initially by training teams. The teams are composed of representatives from each of the four styles to show that efficiency can be increased by about 100%, when compared to any single person trying to do it by himself or herself. Team Members contribute with their greatest strengths, whether they be spatial, observing, verbal, or being active. TQM Teams use a combination of Members whose learning styles are matched as closely as possible to the phases of the problem-solving process. A nice fall-out is that round-table meetings may have seating arrangement as shown in the Plate 14.

```
          ( Modified from Kolb & Basadur of Case Western University )
                                    _________
      4b. Execute the           /    |    \       1a. Choose Model,
          Solution.            /     >     \           or Objective
                              /  4   |   1  \
    4a. Select a             /       |       \      1b. Contrast it
        Solution.           |       / \       |        with Reality
                            |---^--- C ---v---|
                            |       \ /       |
    3b. Evaluate the         \       |       /        2a. Identify
        Consequences.         \  3   |   2  /          Differences
                               \     <     /
      3a. Consider              \____|____/       2b. Select Problem
     Alternative Solutions                            as a Difference
 Team Solvers:  /   Phase 1    /   Phase 2    /  Phase 3     / Phase 4

  DIGgers: >>>>>>>Goal A.;     NOTE: If the Coach cannot form a team with
          \\\    Model B.;           optimum specialized roles, then roles
           \\\      &                may be shared as best can be done.
            \\\  Contrast B. >\
  SIMmers: >>>>>>>>>>>>>>>>>>>>\> Difference B.1.;
              \\\                 Problem B.2.;
               \\\< Feedback <<<<<    &
                \\                Select B.2.>\  Alternative
  COJers: >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  \>Solution B.2.a;
                  \\               \             Solution B.2.b;
                   \\<< Feedback <<<\< Feedback <     &
                    \                \           Evaluate both>\
  WAIers: >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>Select one
                      \                \            \                &
                       \<< Feedback <<<<< Feedback <<\ Feedback <Implement.
```

Plate 15 - Problem-Solving Process

19. Problem-Solving Process. See Plate 15. The process is similar to the way an internal combustion engine works - intake, compress, burn, and exhaust; 1- > 2-> 3-> 4. This is the Learning And Problem-Solving Sequence, LAPSS, and the intention is to go around the circle as one would run laps in a relay race until near-consensus is attained.

This may entail some discussion of sub- problems that may be resolved by using the same process. Note the similarity to the hazard analysis process. Solvers write their inputs to the LAPS plans (See Plate 16) as they go along the process. Each passes on a written statement or question to the next Solver.

After acting, Solvers pass back the plans, including the feedback comments. Alternatives may be evaluated by using "MOST" Factors in Plate 16, Special and TQM Metric Factors.

The COACH-COORDINATOR records actions at each step and maintains plans for future uses, including: goals; contrasts as problems; solutions; evaluations not implemented and reasons why not; and results of implementation and feedback.

In practice, the participants may require moderate adjustments in attitudes towards other persons' techniques and methods of solving problems.

Date: _______ Name: _______________ About: _________________________________

1. Diverger-Idea-Generators pick goals & distinguish from current reality.
1a. ____
1b. ____
Feedback. ____

2. Assimilators identify problems & select a problem to be solved.
2a. ____
2b. ____
Feedback. ____

3. Converger-Optimizer-Judges consider solutions & evaluate them (See 5.)
3a. ____
3b. ____
Feedback. ____

4. Worker-Accommodator-Implementers select & implement a solution.
4a. ____
4b. ____
Feedback. ____

5. "MOST" CALCULATION:	Estimated:	Evaluated:	Implemented:
5a. Probability ________			
5b. Money Cost (-) _____			
5c. Output Profit (+/-)			
5d. Stress+Safety (+/-)			
5e. Time Cost (+/-) ____			
5f. Special/Metric) ____			
5g. Probable "MOST" ____			

Plate 16. LAPS Plan and Record

20. Inventory as Elements. The Double-Tree is expandable to encompass inventory to define the configuration of the system as a double-check to ensure that the model is all-inclusive. The configuration is the tangible and intangible assets of the system inventory. The risk picture is more visible with the descriptions of the purposes of the inventory items included.

Some notions for starting modelling in terms of inventory are:

a. Make an initial estimate of the scope and accuracy desired, such as: a third of an hour of time, $10, and accuracy of 66% probability;

b. List, as line item elements, the tangible, physical inventory items that are available, either through ownership or by borrowing;

c. List intangible assets and liabilities, including skills, knowledge;

d. List working relationships as resources, assets, or liabilities (clients, competitors, partners, superiors, subordinates, peers);

e. Review the lists and model them in the COSMIC preliminary spreadsheet, identifying relationships between the items, such as:
   1.) objectives, obvious or implied, as operational functions;
   2.) interdependencies and interfaces - hierarchical dependencies;
   3.) sequences of causes and effects - processes;
   4.) oversights and omissions in planning;
   5.) relations to "MOST" factors, including risks;
   6.) current operating environment as line items;
   7.) decision-making rules; and
   8.) expected service life.

f. Consider aggregating the resources and assets as packages of tools with identified capabilities in terms of causing changes from specified beginnings to specified ends, in terms of functional process changes.

g. Bearing in mind what the past has shown in terms of inventory, and assuming that no changes are to be made, scan the forecast operating environment, then extrapolate and forecast the most probable future for the operational system, with an associated service life.
   "If you always do what you always did,
   Then you'll always get what you always got,

h. Identify your highest imaginable goals and translate them into specific objectives in terms of specific decision horizons as: 1.) immediate; 2.) short-term; 3.) mid-term; 4.) long-range; 5.) ultimate.

i. Continue the LAPS process by identifying the differences as shortfalls and/or obstructions and the requirements or needs for attaining them.

j. Combine, integrate, optimize, and rank order the plans in terms of efficiency and effectiveness in attaining the objectives.

k. Consider the plans in terms of requirements of resources and match the tool-packs of resources to the requirements.

l. Review the inventory and dispose of unnecessary items.

m. Implement the overall program set of integrated plans.

n. Modify the model for a continuing improvement process.

"If what you know about the problem does not help you to solve the problem, Then what you know about the problem is the problem."

21. Special Factors. With the development and problem-solving understood, the model is further developed. The factors to be used are dependent upon the particular needs of the system to be modelled. Special factors include such considerations as: industrial and governmental or legal standards; socio-economic rules; physical laws; specifications; or human factors such as stress. A mechanism for including the factors to be used in formulae calculations is simply writing in descriptions of factors in the left-hand column and the value of the factor in the cell to the immediate right, as shown in Plate 6 as "NOB". The potential value of this capability may be appreciated in the observation of one over-worked scientist who, upon being informed of the requirements for environmental management, wryly responded,

" The requirements are duly noted and will be added to the 63 others."

	Alt. A		Alt. B		Alt. C		Limit
M* Cost	**MA**	**+**	**MB**	**+**	**MC**	**=**	**ML**
O* Output	**OA**	**+**	**OB**	**+**	**OC**	**=**	**OL**
T* Schedule	**TA**	**+**	**TB**	**+**	**TC**	**=**	**TL**

***Constraints in Linear Programming**

S, Safety	**SA**	**+**	**SB**	**+**	**SC**	**=**	**SO**

Safety as the Objective Function to Optimize

Plate 17 - Operations Analysis

22. Operations Analysis. See Plate 17. In operations analysis, the software being used by Safety Analysis Systems also provides for optimization with linear programming, with sensitivity analysis. This feature will satisfy the chronic problem identified in 5. above, i.e., optimizing safety within the constraints of cost, schedule, and operational effectiveness. The order may also be set up for optimizing output within safety limits.

23. Advanced Spreadsheet Features. Some programs have advanced features.

a. Audit. Capability to audit the data by tracing the formulae and verifying the proper types of inputs is seen as a useful verification.

b. Graphics. The graphics features provide for quick development and presentation of information in various kinds of bar charts, line graphs, etc. Graphics may also be inserted into BOBs to illustrate, as with symbols.

c. "What IF?". Most spreadsheets provide functions for changing inputs to see different outputs. A feature of certain spreadsheet software provides for interactive modelling in real time whereby an output may be changed and the inputs are automatically changed. Sensitivity analysis is available.

P A S T >>>>>>>>>> P R E S E N T >>>>>>> F U T U R E		
Probable		**Probable**
Assets (Resources)	**TransActions**	**Assets (Resources)**
	Profit And Loss	
Liabilities (Requirements)	**Risk Decisions**	**Liabilities (Requirements)**

Plate 18 - PAL-TA-PAL

24. Financial Relationships. See Plate 18. Since the spreadsheet originated in the financial community, it has many features that are useful and are retained in the SHERDQAM. A problem seen in P&L statements is that the data is so compressed that the purposes and relationships are lost. The usual procedure of making Profit And Loss statements, records of transactions, and listings of assets and liabilities are intended to be retained, expanded, and clarified.

	Planning	**Design**	**Mrkt'g**	**Proto**	**Test**	**Proc**	**Mfg**	**Sales**
Management								
Personnel								
Finance								
Testing								
Engineering								
Production								
Facilities								
Equipment								

Plate 19 - Larger Systems

25. Larger Systems. See Plate 19. For these uses, beyond SHERDQAM, which is embedded in each activity, the term COSMIC is used. In larger systems, the various departments or divisions or cost control centers and the people who are responsible for certain and accountable for areas such as facilities, equipment, functions, or on-going events may be managed with individual spreadsheets. While various unique computer tools have been developed for managing organizations, experience has shown that these are oftentimes incompatible with areas such as technical or legal aspects and lack the advanced features found in popular spreadsheets. Such tools oftentimes require dedicated personnel and extensive training. The larger system will be feasible with aggregation, distribution, and cross-linking.

```
 ____________________________
|___|P_|__|__|__|__|__|_X|__|    The COSMIC is inserted from
|___|M_|__|__|__|__|__|_X|__|    the bottom row  of the sheet
|___|O_|__|__|__|__|__|-X|__|    to left into the sheet below.
|___|S_|__|__|__|__|__|_X|__|
|___|T_|__|__|__|__|__|_X|__|          ____________________________
|___|PT|__|__|__|__|__|_X|__|         |QCB|__IX_|__IX_|__IX_|XX|__|
|___|__|__|__|__|__|__|_X|__|         |___|_XI__IX_|__IX_|__|XX|__|
|GT1|T2|T3|T4|T5|T6|T7|T8|TT| <<< >>> |___|__|__|__|__|__|_X|XX|__|
                                      |GT1|T2|T3IT4IT5|T6IT7|T8|TT|
                                      |___|__|__|__|__|__|__|XX|__|
                                      |___|_XI__IX_|__|__|__|XX|__|
                                      |___|__|__|_XI__|_XI__|XX|__|
                                      |___|__|__|__|__|__|__|__|__|
```

Plate 20 - Aggregation, Distribution and Cross-Linking

26. Aggregation, Distribution, and Cross-Linking. See Plate 20 above.

a. Aggregation. For small systems wherein there may be limited memory, COSMIC is amenable to aggregation to higher-level COSMICs, to achieve order of magnitude gains. The mechanism is a simple matter of saving portions of the basic model, such as bottom-line row and right-hand column totals, and inserting them into the higher-level model, wherein one would have an array with formulae that sum from a starting cell to the end total cells. Inserting data between the two cells results in recalculation to include the insertion. Synthesis from the "grass roots" up-chain could identify limiting factors, "LIMFACS", such as maxima and minima.

b. Distribution. The advantage of distribution or allocation is seen in the ability of maintaining focus on top-level or system-level control so as to minimize sub-optimizing. Top managers might allocate resources more efficiently and effectively, with informed information from lower-levels.
Delegation of decision-making authority is crucial for accountability. The feature is similar to military fragmentations (frags) of the main Order of Battle, OB, that are sent from the central headquarters to field units.

c. Cross-linking. The cross-linking between organizations and functions at the same hierarchical level is seen as equally important. COSMIC would seem to be useful where exchanges of medium-sized packets or modules of information are required. Some software features automatic updating of related spreadsheets and databases whenever data is changed in any given sheet or database. Network linking is also available for massive parallel processing.

27. Display for Unification. In a typical organization, the COSMIC should be displayed at intervals or on special occasions such as program milestones to achieve the unity described in the anecdotes concerning the hallway displays. A typical 1 Megabyte sheet would display 4' x 15' in compressed format.
A 2-level 2-dimensional nested sheet would require up to 100 times this space, i.e., 40' by 150'! The advantage of computer display is obvious.

E. WORKPLAN

1. How - Workplans will be determined to a large extent by the government or client; however, the following pattern is provided as a "strawman" for planning purposes. The government or client may select high-risk projects or organizations to be supported as teams.

Month>>	**1**	**2**	**3**	**4**	**5**	**6**
Buyer	**ID Teams**			**Evaluate**		**Evaluate**
TQM Team	**Meet & Train**	**Define Needs**	**Solve Needs**	**Form Model**	**Refine Model**	**Evaluate Model**
S.A.S.	**Train Teams**	**Assist Survey**	**Midterm Report**	**Assist Survey**	**Assist Survey**	**Final Report**

Plate 21 Workplan by Month

2. When - Initial estimate is based on 500 hours to develop a SHERDQAM for a typical project. Intent is for Safety Analysis Systems to provide one day per week support for six months in meetings with the project team.
One day per week meetings are envisaged as a combination of:

a. Assessing needs and training personnel;

b. Analyzing the project and the team members' processes; and

c. Interim surveys of team members' progress to be evaluated.

3. Where - Meetings are envisaged as a combination of mornings with the whole team and evening with individuals, as required.

4. Schedule - Activity will proceed in four phases:

a. Month 1 - 1.) Tutorials on the program;
2.) Assess computer expertise and equipment available;
3.) Form the team and define the processes;

b. Months 2-5 - Assist team members in analyzing the system;

c. Month 6 - Review and Final Report.

5. Final Product - The final product is the computer model of the organization and its relationships and the operational system, with database of TQM Team Meeting Minutes and surveys. One client has noted,
"We can put the project on one diskette and update it when it changes!"

F. RELATED WORK DONE.

See C.9. above and I. below.

1. Defense Aerospace. The various features have been used in the management and supervision of the Safety Divisions under the P.I.'s control. In supervising a group of a dozen professionals, workload was managed with about a dozen disciplines interfacing with several dozen organizations in applying to about a thousand complex defense research projects. The P.I. contributed to improving MIL-STD-882, particularly as regards safety testing and test safety, and various organizational safety plans. The P.I. also contributed to development of combat tactics for interdiction, using operations research analysis to define choke points on supply routes as a member of the tactics panel.

2. Research. The essentials of COSMIC have been applied to:

a. modelling the human life with roles as in Plate 21 and phases;

b. a course of instruction in the psychical sciences; and

c. management of the organization.

3. Education. The P.I. has taught flight instruction. The essentials of COSMIC were applied in adult evening courses and presentations to many organizations on a variety of topics, including COSMIC WISDOM.

4. Vehicle Development. Development of a patented air-ground vehicle has used COSMIC WISDOM principles and techniques.

G. RELATION TO FUTURE WORK.

Since there is no inherent limit to the use of pervasive technologies other than the willingness of people to use it, continued expansion appears feasible. COSMICs may be developed for virtually any system.

1. Phase II. Assuming that Phase I provided sufficient assurance that COSMIC is a cost-effective and desirable technology, ß work may involve coordinating the activities concerned with high risk loss control as mentioned in C.3. above by inviting professional groups and societies to consider SHERDQAM.

a. Further work might replicate with other organizations and projects.

b. A report of Phase I activity might be made available to other government agencies, software developers, industry and academia for further application.

c. A particular interest of the P.I. is exploring the feasibility of developing the COSMIC as an artificial intelligence engine.

2. Phase III. Work might involve exploring the feasibility of expanding applications of COSMIC to the areas mentioned in H below. A particular interest of the P.I. is the application of COSMIC in central control station display systems. The concept is that of a display that will show a system operator the status and potentials of a quasi-automatic operating system that requires human monitoring and real-time decision-making. Hardware might involve "video wall" technology with multiple display screens with animated flows and color-coding, and instrumentation interfaces for inputing and outputing. Included in this class are:

1.) Building environmental and security systems;

2.) Transportation and communication systems;

3.) Organizational management;

4.) Maintenance and Test operations;

5.) Vehicle control, such as aircraft, ships, etc.;

6.) Tactical and strategic situations;

7.) Political systems.

3. Standard. A draft standard is shown below.

Draft Standard

Computerized Operational System Modelling for Integrated Control
for
Workable Intelligent Systems Development, Operation, and Maintenance

" C O S M I C   W I S D O M"

0. PURPOSE: This standard is intended to describe assumptions and standards for COSMIC WISDOM. Users are encouraged to make their models available to all concerned. Safety Analysis Systems shall act as SYStem OPerator, SYSOP, for COSMIC interchange and repository.

1. ASSUMPTIONS: It is assumed the system operator is competent in using the hardware and the software as a system.

1.1. HARDWARE: A computer workstation with the following hardware:

1.1.1. All equipment shall meet or exceed national consensus safety and health standards for electrical/electromagnetic operation.

1.1.2. Stations shall consider ergonomics in operation, including seating, duty periods (1:20 on/:20 off), and illumination.

1.1.3. A monitor, a printer, and data storage media;

1.1.4. A floppy disk drive of at least 128 Kb capacity;

1.1.5. Random Access memory of at least 128 Kb is desirable.

1.1.6. Communications capability is desirable.

1.2. SOFTWARE: The COSMIC operation assumes the following common program software with display, printing, and save and retrieve capability. Software shall be compatible with USASCII standard.

2.1. Text word processing for common reading and writing;

2.2. Database for repetitive entries and logs (See Plate 5.);

2.3. Spreadsheet program as described in D> Technical Objectives.

2. STANDARDS: COSMIC models shall conform to the following guidance.

2.1. Specifications shall be maintained in a Legend file, either in the model (preferably in the leftmost column) or separately filed, (enter location of legend in A1) with the following information:

2.1.1. The date when the COSMIC was saved;

2.1.2. The name and address/phone number of the analyst;

2.1.4. The end cell row-column identifier;

2.1.5. The line items concerned as in Plate 21;

2.1.6. The numerical or statistical accuracy of the model.

2.1.7. Related spreadsheets for aggregation or distribution.

2.2. The on-going entities shall be described in a contiguous group of cells, either BOBs, NOBs, or both. (See Plates 5, 6, and 9.).

2.3. Initial state of entities shall be described in the leftmost column.

2.3.1. The flow of action shall be from left-hand to right-hand.

2.3.2. Cells to right shall be reserved for changes in the entity.

2.3.3. The rightmost BOB shall be for the final (objective) state.

2.3.4. Upper rows are for controlling items, lower for controllees;

2.4. Tolerance build-up shall be considered for accuracy.

2.5. Space (blank column/row) between BOB/NOBs shall be a minimum of:

2.5.1. One character when the BOB is marked with a border; or

2.5.2. Three spaces when not marked by a border; or

2.5.3. Five spaces when a connector line mark is included.

2.6. If "PMOST" is used, then the factors shall be defined as in Plate 6.

H. POTENTIAL POST APPLICATIONS

The COSMIC proposal may be published as a guide. The method might be used in educational instruction and applied to the following areas.

1. **Modules in Libraries.** As COSMICs are developed, they may be viewed as modules that may be interchanged and synthesized, adapted and adopted, in a manner similar to "shareware" on electronic bulletin boards and forums. The information system might evolve into an encyclopaedic reference system. There will be a need for language translation.

2. **Auditing and History.** These might be enhanced by the modelling of high importance activities at any level of complexity for lessons learned. This might include aggregating mishap reports from the myriad of government and industry agencies and assimilating them for planning.

3. **Health Maintenance.** As reflected in "The Oregon Plan" may be considered, including psychoneurobiology, parapsychology, and psychical sciences. This might also include biological, psychological, and genetic, neurological subsystems, interacting with nature and society.

4. **Insurance.** The insurance industry, per se, would likely benefit, as would those who elect to self-insure. As an example, buyers may wish to have a safety analysis and legal verdicts for products for buying decisions.

5. **Arms/HAZMAT/RAD Proliferation Control.** Tracking of arms, hazardous materials or emitters or advanced technologies might be enhanced.

6. **GUEST.** Globally Unified Environmental Safety Teams - GUESTs on Earth may develop and use definitive models of ecosystems.

7. **Integration of Large Systems.** COSMIC technology might provide for better integration of large systems, including:
   a. Educational curricula, with follow-through to employment and thence to occupational and professional career paths;
   b. Employee "Position Descriptions" as "Process Prescriptions" for government in civil service, military, and collective bargaining.

8. **Human Relations.** Some corporations, including political entities, have questionable means of describing their organization and operation totheir tax-paying citizens. They might benefit from using COSMIC for communicating with voting and non-voting citizens and stock-holders.

9. **Specifications and Standards.** Both governmental and industrial, the problems mentioned above are seen as a call for review. The 35,000 specifications and standards might be easier to work with if they were COSMICs for identifying definitive processes, interdependencies and quality measures. The ISO 9000 standards seem to be a fertile area,since they call for process controls that might be described with COSMICs.

10. **U. S. Code of Federal Regulations.** This might be considered for review to see how the directives are actually implemented and the value added or cost avoided via aggregation with LIMFACs. This might include providing citizens a COSMIC of the laws they are subject to.

Dewey #s	SIC #s	Line Item #s	B u d g e t / P l a n L i n e I t e m s
00		42	Knowledge, cybernetics, systems, controversial
01,03,&93		41	History & Forecast, Biblios, Encyclopedia
40		40	Language & Linguistics
32	91-97	39	Political Science, Government, Citizenry
02	82	38	Libraries & information science & Museums
		37	Employee, Co-Worker, Boss, Manager
10		36	Philosophy, metaphysics, ontology, cosmology
13	80	35	Paranormal, parapsychologists
15,16,17	80	34	Psychology, Logic, & Ethics
50,52,53	89	33	Pure Science Mathematics, Astronomy, & Physics
54,62,66	51	32	Chemistry, Materials, & Fuels
62	87	31	Technology & Engineering (Safety cons.8742-08)
	64	30	Accidents & Mortuary Affairs & Insurance
60	80	29	Health & medicine
20	86	28	Religion & Churches, Ideology Group Member
36	81	27	Law & Administration
34	92	26	Crime, Enforcement, & Corrections
33	87	25	Economics & Business Management (Save/Invest)
30	83	24	Sociology, services, SIGs, statistics
37	82	23	Education & Training
73	84-86	22	Arts, performing & Entertaining
80	84-86	21	Literature, poetry, music , graphic arts
79,91,99	27&79	20	Recreation, Sports, & Travel-psychic mediums
65	67	19	Management & auxiliary services & Insurance
38	52	18	Trade and Sales
38,33,65	48-49	17	Communications & Utilities
07,09	27	16	Journalism, periodicals, manuscripts
67	20-39	15	Manufacturing, Refining, & Maintenance
38	40	14	Transportation & Distribution
72,69,62	15	13	Architecture, Building, Construction & Housing
06	84	12	General Organizations, Friends/Antagonists
39		11	Customs & folklore (Diet, Dance, Dialect)
38	72	10	Personal Services (Grooming, Cleaning)
64		9	Home & Family (Parent, Sibling, Son/Daughter)
		8	Personal/Pair Genetic Improvement & Survival
30,57,92		7	Life Sciences, Anthropology, & Geneaology
58 & 59		6	Botanical, & Zoological Sciences
63	01	5	Agriculture & Livestock
63	09	4	Trapping, Hunting, & Fishing
62	14	3	Mining & Energy Extraction
55 & 90	27,89	2	Earth sciences, Geography, & Disasters
50		1	Inertia, Gravity, & Radiation

Plate 22 - Very Large Systems

11. Very Large Systems. See Plate 22. For National/Global Planning, line items are shown as a hierarchy. "Dewey" is for (Melvil) Dewey Decimal Codes; "SIC" is Standard Industrial Classification codes.

12. Personal Life Planning with COSMIC. Persons and families may use the

COSMIC system for planning, modelling, and recording their activities.

```
   Col. B                  D             F              H            J            L
                        Youth         Mating and     Middle Age   Mellowing    Retirement
Social Life Phase->     School        Acquisition    SocialClimb  Leadership    Advising
Approx.Phys.Age-->>      8 - 24       24 - 40        40 - 56       56 - 72     72 - 88
------------------------------------------------------------------------------------------
Highest Potential--->              >              >  A display of 4' tall ( 3' to 7' high),

Core Personality---->              >              >  and 20' wide would accomodate about

Religious/Ideology-->              >              >  30 elements in "MOST" format.
------------------------------------------------------------------------------------------
National Member----->              >              >

Regional/State Mbr-->              >             >   Allowing 40-character NOB's @ 12 c.p.i.,

Diplomat-Leader----->              >             >   this would allow 72 phases or years.
------------------------------------------------------------------------------------------
Professional Mbr---->              >             >
                                                     The aggregated COSMIC for a person's
Business Officer---->              >
                                                     or a family's system may be set up
Worker/Co-Worker---->              >
                                                     from the viewpoint of functional roles
Consumer------------>              >
                                                     that are to be fulfilled in phases.
Student-Apprentice-->              >
                                                     Phases may be analyzed in quarters,
Community Leader---->              >
                                                     weeks, or however desired. Budgets
Community Member---->              >
                                                     may be included. Key questions are:
Friend (Same Sex)--->              >
                                          Where do you want to be twenty years from now?
Friend (Opp. Sex)--->              >
                                          What are you planning NOW to achieve these goals?
Adversary-Competitor>              >
------------------------------------------------------------------------------------------
EXTENDED FAMILY:--->               >

Grandparent:-------->              >

Parent:------------->              >

Spouse or Mate------>              >

Son/Daughter-------->              >
------------------------------------------------------------------------------------------
```

Plate 23

Preliminary COSMIC for Personal Life Planning for Expected Service Life

I. KEY PERSONNEL.

The P.I. was a participant in recent organizing of the Aeronautical Systems Division and Wright-Patterson AFB Environmental Protection Committees and participating in the DoD Tri-Service System Safety Panel on Laser Safety. Participated in Operational Improvement Task Force for the City of Dayton.

The P.I. has participated in approximately 1,000 R & D projects, including several programs that were the first of their kind, such as: first military communications satellite; first long-endurance drone aircraft; first flight operation of a chemical laser.

See **WHO'S WHO IN SCIENCE AND ENGINEERING/ THE MIDWEST.**

1. Professional Background:
- Military reserve duty in Naval Air Reserve as aircraft mechanic;
- Command Pilot as Instructor & Transport Pilot and Forward Air Controller.
- Military active duty in the Air Force Systems Command; assigned to:
  - Space Systems Division Communications Satellite Test and Deployment;
  - AFSC Inspector General Safety Office;
  - Aeronautical Systems Division
    - Reconn/E.W. Office for Safety, Reliability, and Quality Assurance;
    - Deputy for Engineering Group Leader for System Safety Engineering.
- One-year hiatus from Federal work; employed with major aerospace firms as Senior Systems Engineer in Research & Development on Aquila reconnaissance drone and XV-15 tilt-rotor aircraft.
- Department of Air Force Safety Engineer:
  - Lead System Safety Engineer with 4950th Test Wing;
  - Wright Laboratory; Chief of the Safety Division. Developed and implemented, over a five-year timeframe, an integrated occupational safety & health, system safety, & environmental protection program.

2. Education:
- B.Sc., Aeronautical & Astronautical Engineering, University of Michigan;
- M.A., Industrial Management & Supervision, Central Michigan University;
- Professional Military Education through Air War College.

3. Awards and Certifications:
- Commendation Medals for "acquisition of safer systems at lower costs";
- Assisted Wright Laboratory attaining three National Safety Council Awards;
- Registered Professional Engineer in Ohio;

4. Professional Memberships:
- System Safety Society (Senior Member).
- International Test and Evaluation Association.
- American Society for Safety Engineers.
- Engineers Club of Dayton.

5. Patents:
- display systems (24-hour clock dials); and
- multi-mode vehicles (aircar/autoplane) and flight controls.

6. Papers:
- Master's thesis on management of safety;
- Air War College technical report on personal computers for management;
- System Safety Society papers on trade-offs for life cycle cost;
- System Safety Society papers on personal computers for safety management.

7. Other: CEO/Editor of educational & scientific research organization 17 years involving the psychical sciences and parapsychology.