Sample Problems for the TRIZ Associate Certification Test

A. Function Analysis

A-1. Formulate primary functions performed by:

- Shaving razor
- Toothbrush
- Mailbox
- Flashlight
- Ski

A-2. Rank functions performed by different components of:

- Shaving razor
- Toothbrush
- Mailbox
- Flashlight
- Ski

B. Problem Modeling and Problem Solving

B-1. Formulate conflicting parameters (i.e., system conflicts, or technical/engineering contradictions) for modern mobile phones.

B-2. In a robotic test station for computer components, the gripper of the robot (Fig. 1) performs complex manipulations (clamping, handling, and inserting) with very delicate parts in a clean room. It is energized by two vacuum lines and four compressed air lines and has several sensors transmitting signals via electrical cables. All vacuum, compressed air and electrical communications are channeled to the distribution/control box at the robot's base by a corrugated plastic hose encasing all the tubes and wires. The purpose of this hose is to prevent the contamination of the clean room by containing fine particles generated by any rubbing between the tubes and wires. The hose has shown a tendency to rupture in service. The rupture was due to fatigue associated with large amplitude, high-speed link motions resulting in an excessive twisting of the hose. This allowed the wear particles to escape into the environment and caused excessive contamination due to the rubbing between the ruptured surfaces themselves.

The test station manufacturer incurred large warranty costs (sending technicians to the customer locations to replace ruptured hoses every two-three months). The company was trying to improve the situation by solving the problem: *How to prevent the breakage of the hose?* Use of more durable plastics for the hose was more expensive, and did not significantly expand its useful life. Creating a negative air pressure in the hose was suggested, thus preventing the dust particles from escaping but that, also, would have increased costs.

Use trimming to improve the situation.

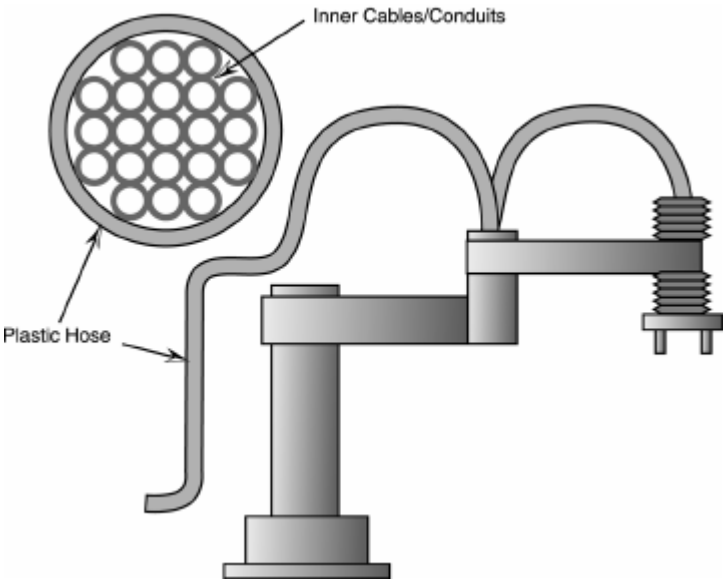

Fig. 1: Robotic test station.

B-2. The 230,000-lbs. base of a blast furnace is moved next to a foundation well (Fig. 2). How should the base be lowered into the well? Of course, special cranes can be used, but this would significantly increase the complexity and cost of the operation, and may not be reliable. What should be done?

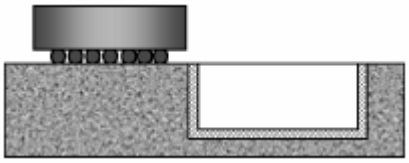

Fig. 1: The blast furnace base needs to be lowered without special equipment.

B. Laws (Trends/Patterns) of Engineering System Evolution

C-1. Give five examples of consumer products that can be characterized as:

- Homogeneous bi-systems
- Heterogeneous bi-systems
- Partially convoluted bi-systems
- Inverse bi-systems
- Completely convoluted bi-systems

C-2. Give one example of the evolution of a product along each of the following trends of evolution:

- Transition to a super-system
- Transition to more flexible (dynamic) system
- Transition to a micro-level

- Line of completion
- Shortening of energy flow path