ASIT Case Study: Parking Problems

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Editor's note: Dr. Roni Horowitz, author of the ASIT newsletter, and a frequent contributor to the TRIZ Journal, asked his newsletter readers to contribute their case studies. Then, more than a thousand readers voted on the best cases. The TRIZ Journal has asked the winners to let us reprint their case studies—the first one appeared in the April TRIZ Journal. Dov Tibi has sent us all three of his contest entries to publish here. For more information on ASIT, see the August, September, and November 2001 issues of the TRIZ Journal, or the on-line ASIT class, in the Products and Services section of this issue.

The problem world

1. As in most of the places in our country, there is a serious problem of parking places in the XYZ University campus (especially in the center of the campus, where all the important functions are).
2. The way the university authorities are dealing with the problem is by restricting the entrance of cars to specific parking zones. Each authorized person gets a "one year parking label" that he sticks to the front car window. The color of the label defines the allowed parking zone.
3. The academic staff has a privilege of getting a red label which indicates the permission of parking in the entire parking zones.
4. Since all of the academic staff has more than one car (some even have three cars) they demand (and get) more than one parking label (Their argument: "I don't know with what car I will arrive to the university.")
5. The problem in the current situation is: each academic staff member has more than one car with a red parking label, although he can enter only with one car at a time, his family members are using the advantage of having cars with red labels and enter with the other cars.

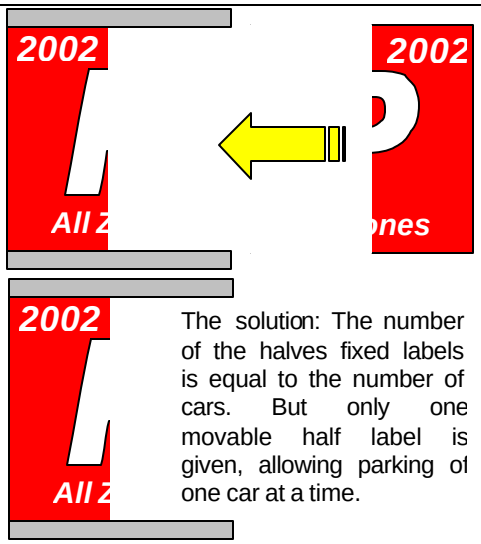
The ASIT solution

1. The ASIT ***Closed World*** principle, forces us to work on a solution based on the problem world components. A solution of adding a new component to control the entrance of authorized persons and cars only

(for example: adding a camera and matching faces with a data base) violates the ***CW*** principle.

2. So we focused on using the parking label as the only control tool for entrance and parking.
3. Limiting each academic staff member to one parking label is an unacceptable "more of the same" solution due to the academic staff argument mentioned above.
4. Changing the label from "fixed to the window" label to a movable label (thus giving only one label to a person, allowing him to move it from one car to another) is also problematic since the label can be circulated among friends (for example: when the person is in vacation or out of the country).
5. The ASIT solution that was found was based on the ***Qualitative Change*** principle, using the ***division*** tool. Instead of having a fixed label or a movable label, let divide the label to two halves. One half will be fixed and will be stick to the window and the other half will be movable. Each academic staff person will get **several** fixed halves (as the number of cars he owns) but only **one** movable half. In order to enter the campus and park, the car must have a full label (combined of the fixed half and the movable half).

The problem: The number of labels is equal to the number of cars.
More than one car can park in the campus simultaneously.

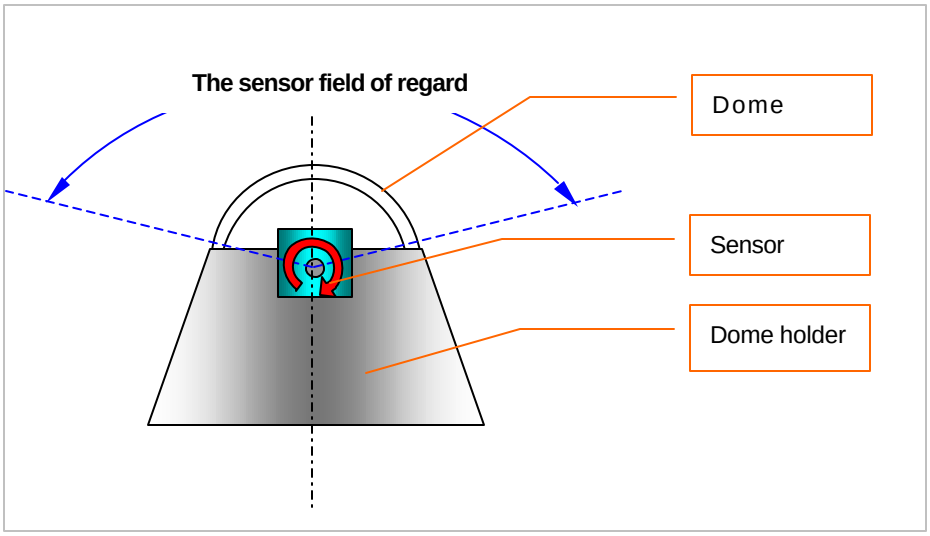


The solution: The number of the halves fixed labels is equal to the number of cars. But only one movable half label is given, allowing parking of one car at a time.

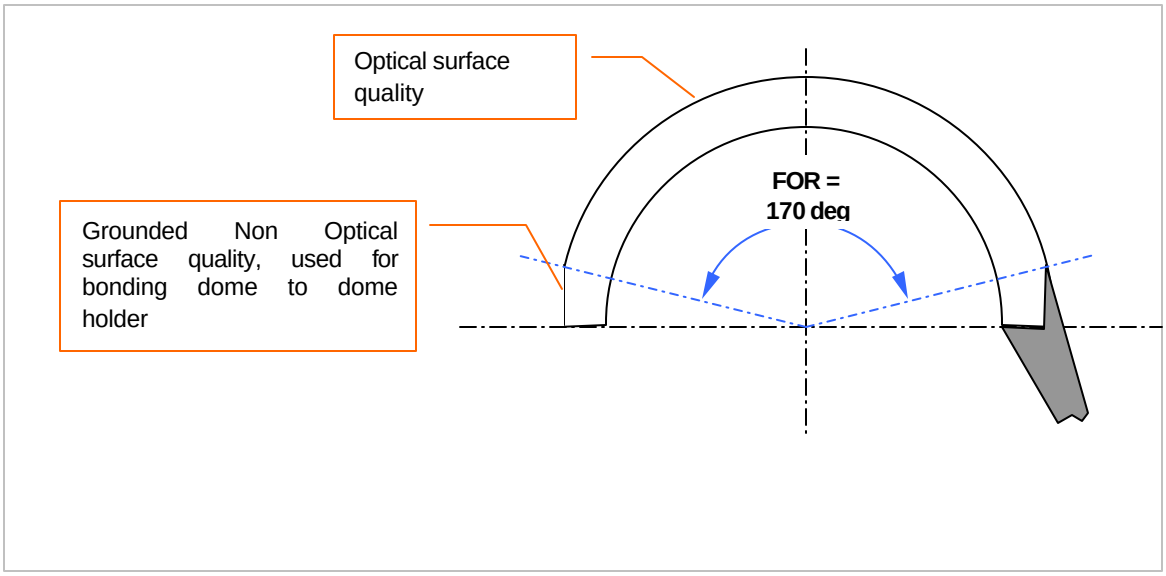
Missile Dome

The problem world

1. An electro optic missile has a field of regard (FOR) that is limited by the angular size of its optical dome.

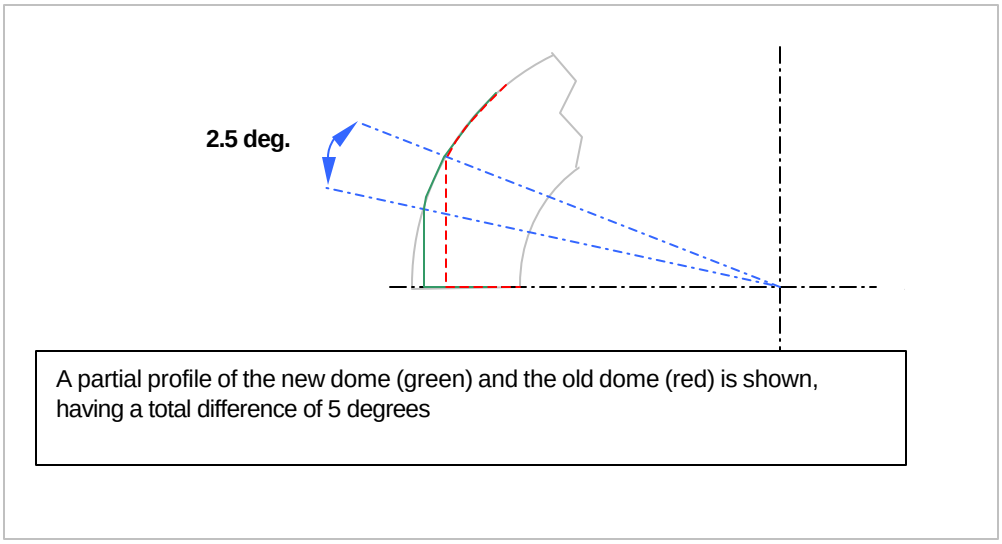


2. The FOR of Black Arrow (just a name) missile is 170 deg.



3. After several years of production, and due to advanced missile software version it was found that enlarging the FOR to 175 deg. will improve considerably the operational envelope of the missile.

4. The straight forward engineering solution was to enlarge the dome by 5 degrees (2.5 deg. per side).



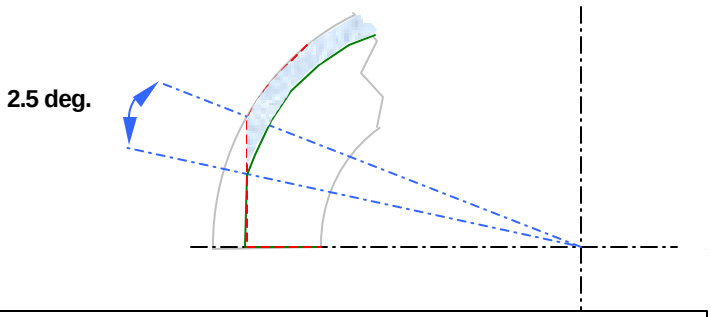
A partial profile of the new dome (green) and the old dome (red) is shown, having a total difference of 5 degrees

5. During the dome redesign it was found that there is a lot of about 100 old domes (170 deg.) that can't be used in the new configuration (it is impossible to add extra material to an existing optical component and keeping the optical performance).

The ASIT solution

1. The problem that was defined is: How to use old "170 degrees" domes in a missile requiring a FOR of 175 degrees?
2. Adding a complicated mechanism to the sensor optics (as a folding mirror) in order to get the extra 5 degrees was out of the question from the engineering point of view (which at that case agrees fully with the ASIT ***Closed world*** principle of not adding new components to the system).
3. So the defined problem was changed to: How to modify the old "170 degrees" domes to "175 degrees" dome without adding material to the dome?
4. The ASIT tool ***reduction*** (less is more) was applied, to come up to a solution.
5. The outer radius of the old dome was slightly reduced in order to get a larger dome angle to the desired value of 175 degrees. Due to geometric consideration a very small change in the outer radius will

give a big change in the angle so the dome thickness was almost not influenced from the change and no other system parameters (optics, strength, etc.) where changed.

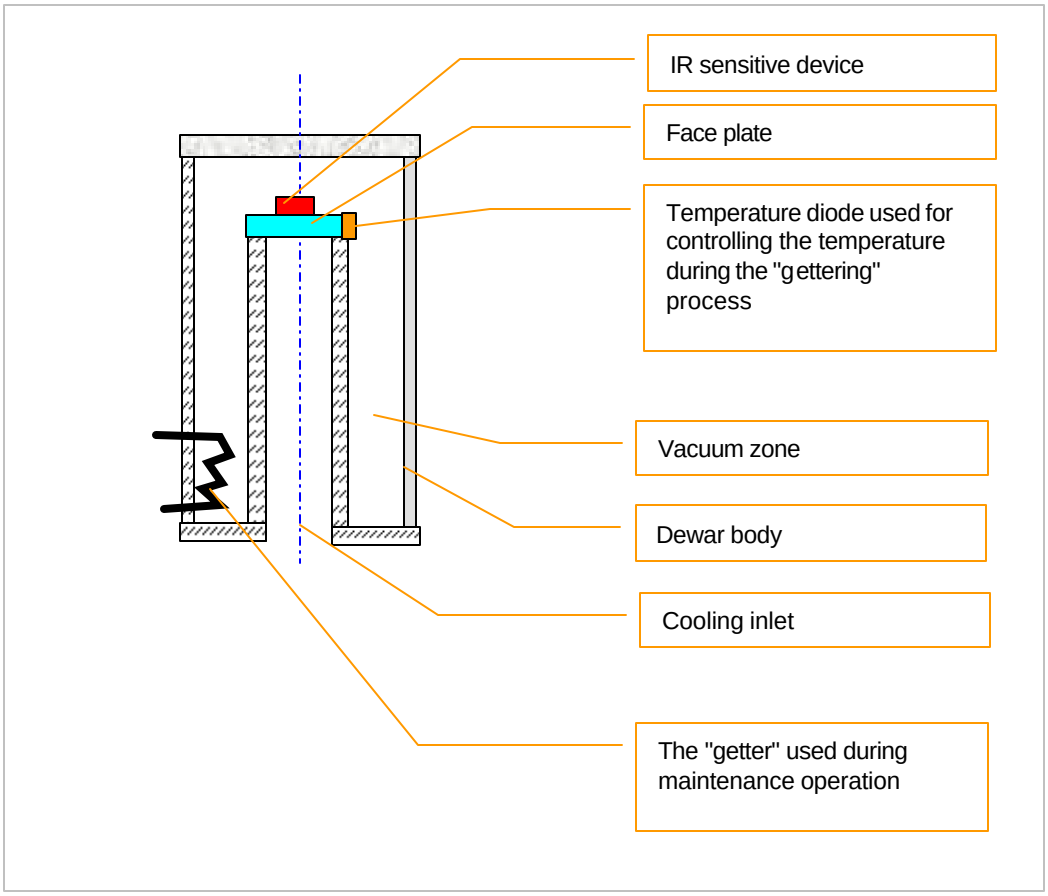


A partial profile of the new dome (green) and the old dome (red) is shown, having a total difference of 5 degrees, the material that was removed by optical polishing is shown in blue (the drawing is not scaled).

Temperature measurements

The problem world

An IR (Infra Red) detector is a very sensitive device used in missiles to sense the thermal signature of targets. The main reason of the superior sensitivity of the detector is the fact that the detector face plate is cooled to cryogenic temperatures (around 70K or minus 200deg.C). In order to reach this extremely low temperature the detector is packed in a vacuumed dewar (just like a tea thermos) and a cryogenic cooler is used. Since the vacuumed level should be maintained for several years, a special maintenance operation is performed every five years. The operation is called "gettering". A high electrical current passes through the "getter", warm it and causes the vacuum level to be high again for more 5 years.



In order to have an effective "gettering" process, the face plate temperature should be controlled to the range minus 50c to plus 50c (a higher temperature may cause damage to the detector and a lower temperature is not effective

for "gettering". Thus a temperature diode is mounted on the face plate and is used to control the temperature during the maintenance process (it should be emphasized that the only use of the temperature diode and the "getter" is during the maintenance process and not during the operational phase of the system). And now to the problem…

A lot of several dozens of detectors was manufactured (each detector is a very expensive device). During the acceptance tests it was found that the electrical connection of the temperature diode is not reliable and it is not sure that it will function during the "gettering" process (5 years from now). Limiting the life of the detectors to 5 years was out of the question from the customer point of view. Opening the vacuum zone in order to fix the bad connection will damage about 50% of the detectors, thus it is not economical.

The ASIT solution

1. The problem that was defined is: How to be able to perform the "gettering" process **efficiently** despite the bad connection of the temperature diode? Or, in other words, is there another way to measure or control the temperature during the process?
2. In this case, the ***Closed world*** principle is a must by definition - we already have a system that can't be changed, on one hand, and must perform a non existing function (temperature control), one the other hand. The obvious ASIT tool to be used, in this case, is ***unification*** (we have to find a component that exists in the problem world and can perform the new function of temperature control).
3. The components list includes: temperature diode, IR device, face plate, dewar body, "getter", cooler, current supply.
4. The solution that was found and adopted is: using the sensitive IR device for temperature control. The electrical noise that is produced from the device while operating is proportional to the device temperature (the higher the temperature the higher is the noise), as a matter of fact that is the reason, in the first place, that a cooler is used – to reduce the electrical noise. The IR device is not accurate as the original temperature diode , but there is no need to know the accurate temperature of the face plate, it is sufficient to know that the

temperature is within a range of 100 degrees C (higher than minus 50C and lower than plus 50C)