



---

# **The Essence of the Inverted Risk Countermeasure Method "AFD" in I-TRIZ - How about Becoming a Saboteur? -**

---

**Teruyuki Kamimura  
Certified I-TRIZ Specialist  
Ideation Japan Inc.  
Ideation International Inc.**

---

# 1. SELF INTRODUCTION

# Introduction of Ideation Japan Inc.

■ United States Ideation International Inc.

■ Willfort international patent firm

It cooperates, and customer's technological innovation is supported from the three side of developing, intellectual property, and making to the business.

● Establishment in May, 2010

● Japanese representative partner of TRIZ consulting company "Ideation International and Inc." of the United States (III Co.)



# The entire image of I-TRIZ "Office of Innovation"

## Office of Innovation

創造的  
問題解決

Inventive **P**roblem  
**S**olving

Systematic process to solve difficult, technical problem of related to performance improvement, functionality expansion, quality improvement, and cost decrease, etc. of product and

先行的不具合対応  
Anticipatory **F**ailure **D**etermination

不具合解析  
Failure **A**nalysis

Systematic process to ascertain primary cause for occurring trouble, breakdown, and failure and to solve it promptly

不具合予測  
Failure **P**rediction

Systematic process to prevent potential trouble, breakdown, and failure that will occur in the future forecasting beforehand

戰略的  
世代進化

Directed **E**volution

Systematic process to evolve generation in the future of system from a strategic standpoint

知的財産制御

Control of  
Intellectual **P**roperty

Systematic process to enhance value of literary property and to improve deterrent and offensive power to violation and evasion

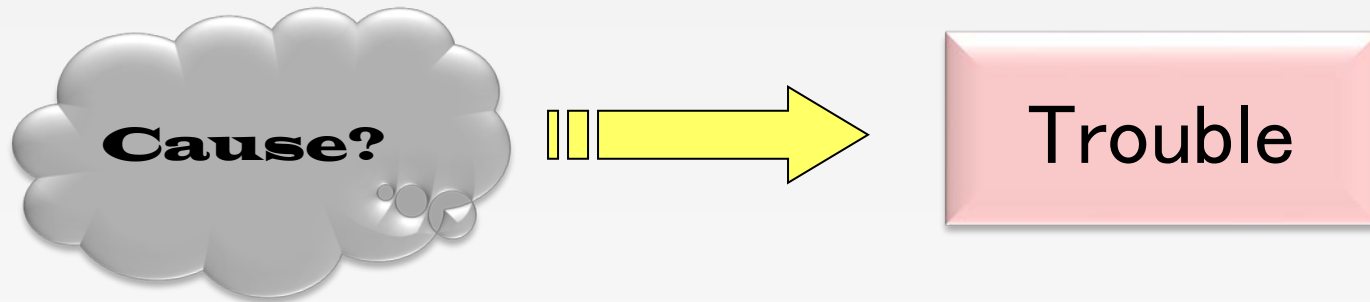
---

## **2. WHAT IS ANTICIPATRY FAILURE DETERMINATION(AFD)?**

# Two kinds of processes of AFD

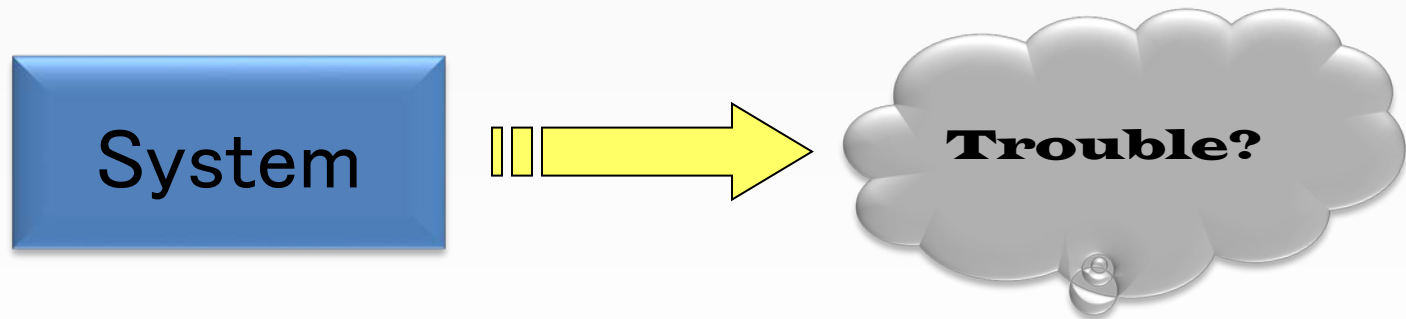
- Trouble analysis FA (Failure Analysis)

The primary cause for the occurring trouble is clarified and removed.



- Trouble forecast FP (Failure Prediction)

The trouble that can occur in the future is forecast and prevented.



# Past investigation into the cause method and what are different as for AFD FA?

- Past trouble investigation into the cause method  
Information on similar past trouble is clarified and the cause is clarified to reliance.
- When the breakdown similar to past occurs repeatedly, it is effective.
- However, the clarification of the following trouble is difficult.
  - ◆ The first trouble without experience in the past.  
(There must be "First time" also in what. )
  - ◆ It is doesn't remain the information or insufficient trouble though it might have been in the past.  
(Trouble information is mostly buried to the dark. )

## ● FA of AFD:

To be interpretable of the cause mechanism even if it is the first trouble not experienced, it is made.

# Past forecast method and what are different as for AFD FP?

- Past trouble forecast method: FMEA, HAZOP  
It thinks what occurs when each element under the design changes based on the design of the object system.
- Trouble cannot be forecast according to the factor of "Outside assumption" not intended by the design.
- It takes a great amount of time for the analysis.  
There are a lot of components of the system, and the variation of the change in the element and the combination are near infinity.

## ◆ FP of AFD

- To be predictable of the breakdown by a cause outside assumption, it is made.
- It is made to be predictable in a more short time.



---

## **3. THE MAXIMUM FEATURE OF AFD: SABOTAGE ANALYSIS**

# Thinking as a saboteur

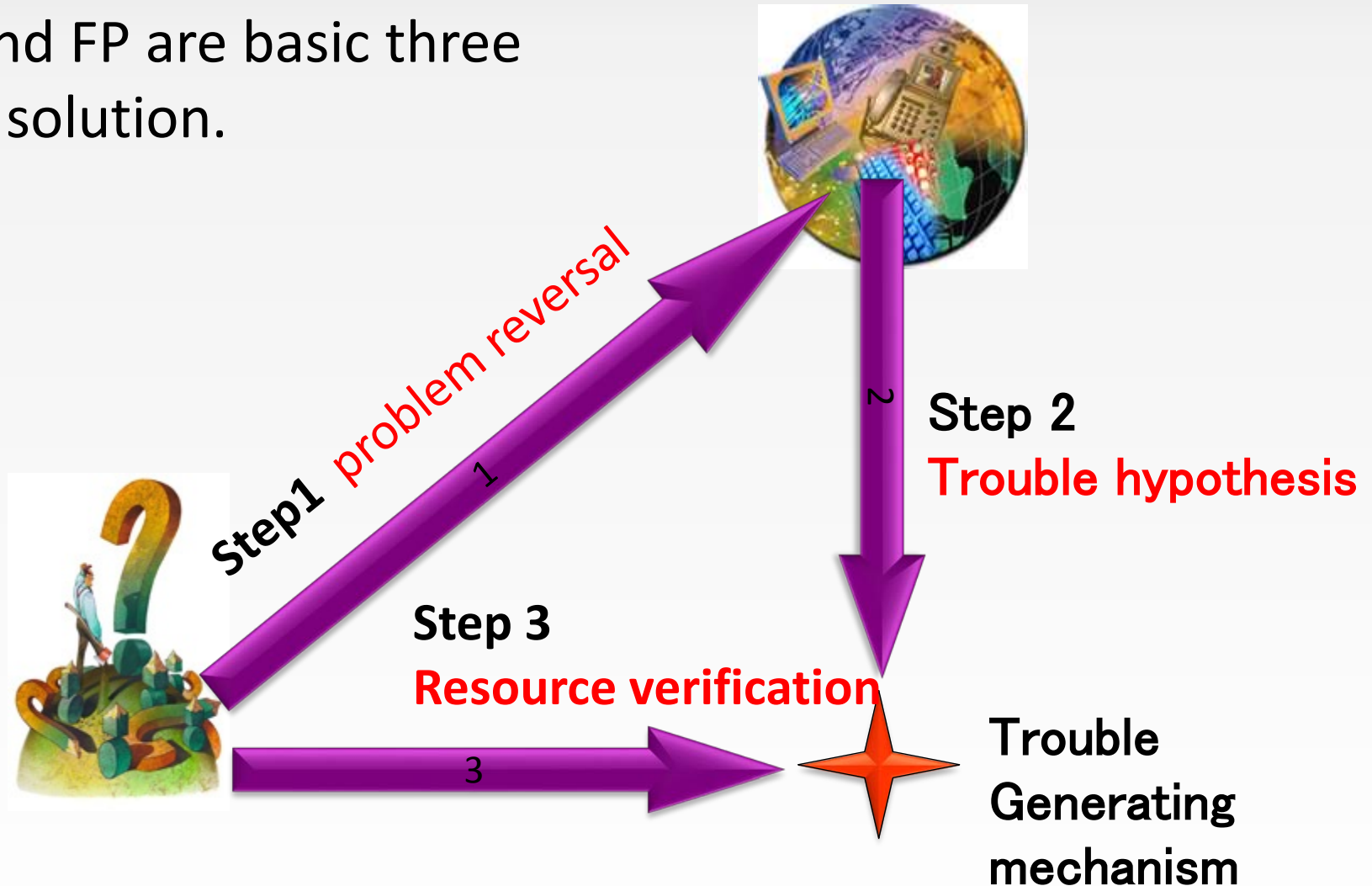
- Advantage of AFD:
  - ① The cause of the first trouble is clarified.
  - ② Trouble outside assumption is predictable.
- The secret is an approach method "Sabotage analysis".
- It is not a side where the system is defended.  
It stands in the standpoint of "Saboteur" that attacks the system.
- 「Will how do it do and will I cause trouble? Will I destroy it?」It thinks. "Trouble is invented. "

# Effect of "Sabotage analysis"

1. The defect of the design is seen well by becoming a cracker.
  - As for painful trouble, the criminal is hiding by him/herself in the place where the designer did not intend it at all.
  - Because the hiding place is not seen, it becomes outside an uncertain cause or assumption so far.
  - The idea extends it to the place in which it did not see it by thinking that trouble is caused from the cracker side in the designer. The criminal who hid by him/herself is found.
2. **Abundant knowledge and tools to invent it can be used.**
  - Abundant techniques of IPS (invented problem solving) that is a systematic process to invent it can be used.
  - Trouble is a neutral originally natural phenomenon. It is often used for a useful purpose in another field. A variety of generation methods of trouble are found if searching for the technical intelligence of a profitable purpose.
3. As a result, the accuracy rate and the speed of investigation into the cause and the fault prediction improve.

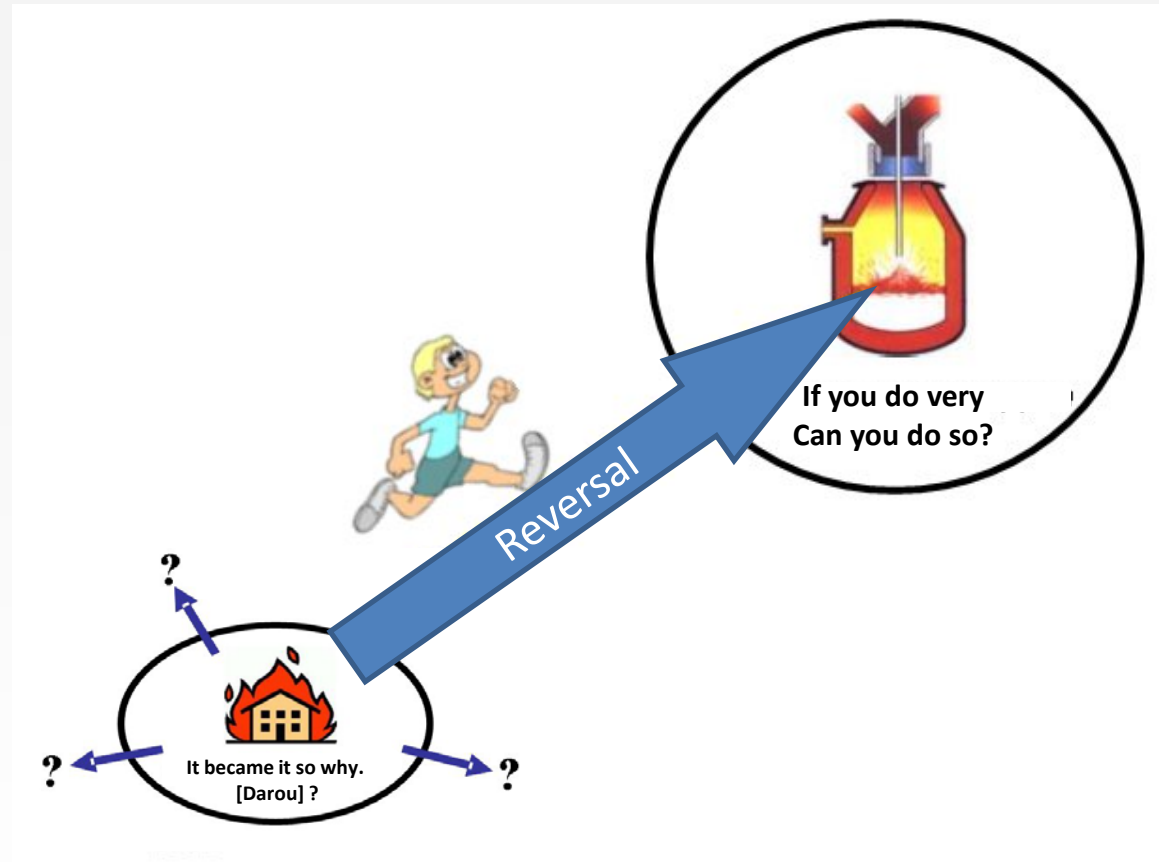
# Basic technique of AFD: Three steps solution

FA and FP are basic three step solution.



# Step 1: Invert the problem

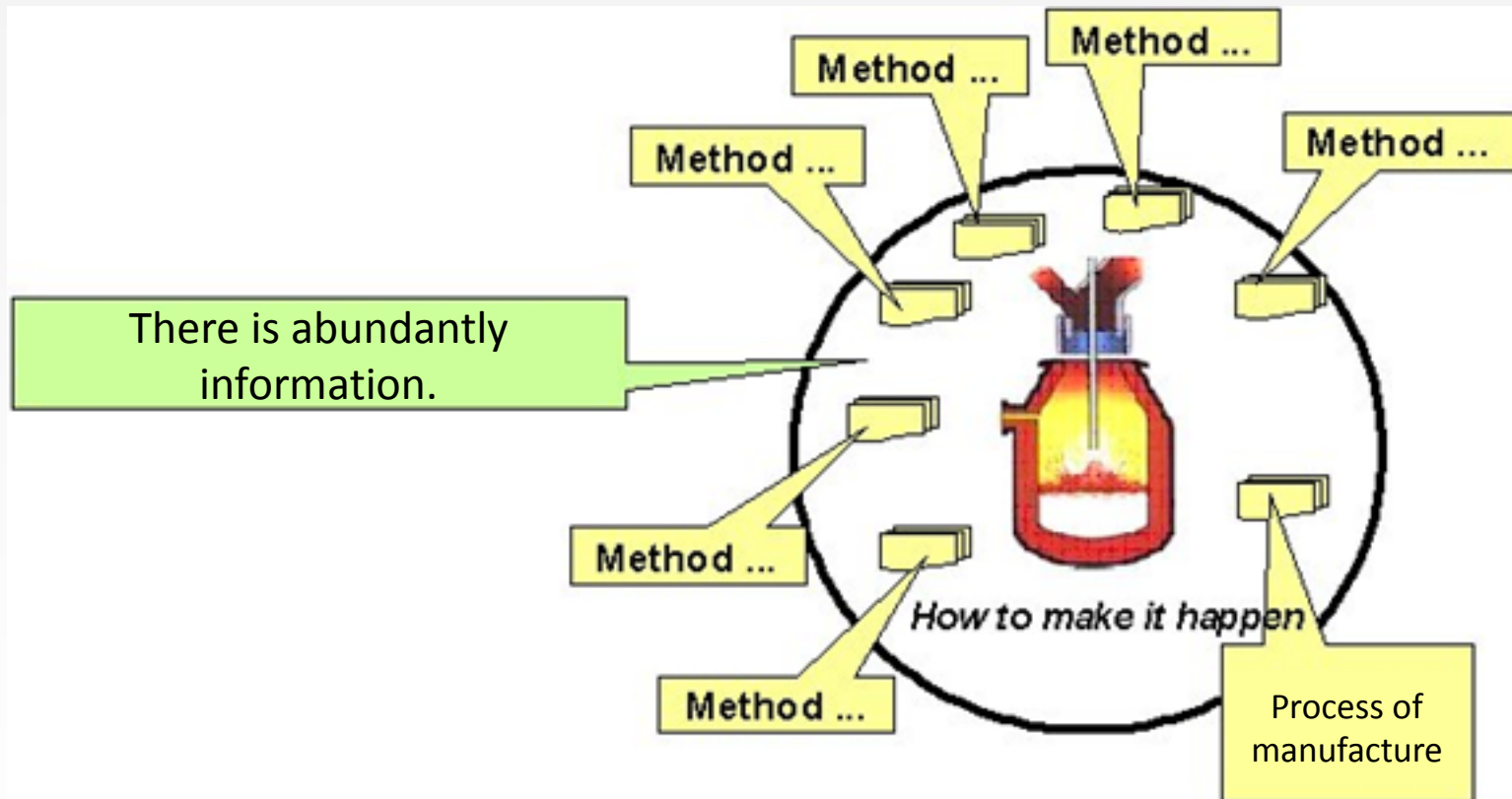
The problem "Why does trouble occur?" is converted to the problem "How can I cause the same, natural phenomenon?".



# Step 2: Set up a hypothesis for the trouble

It begins to devise the method of causing trouble.

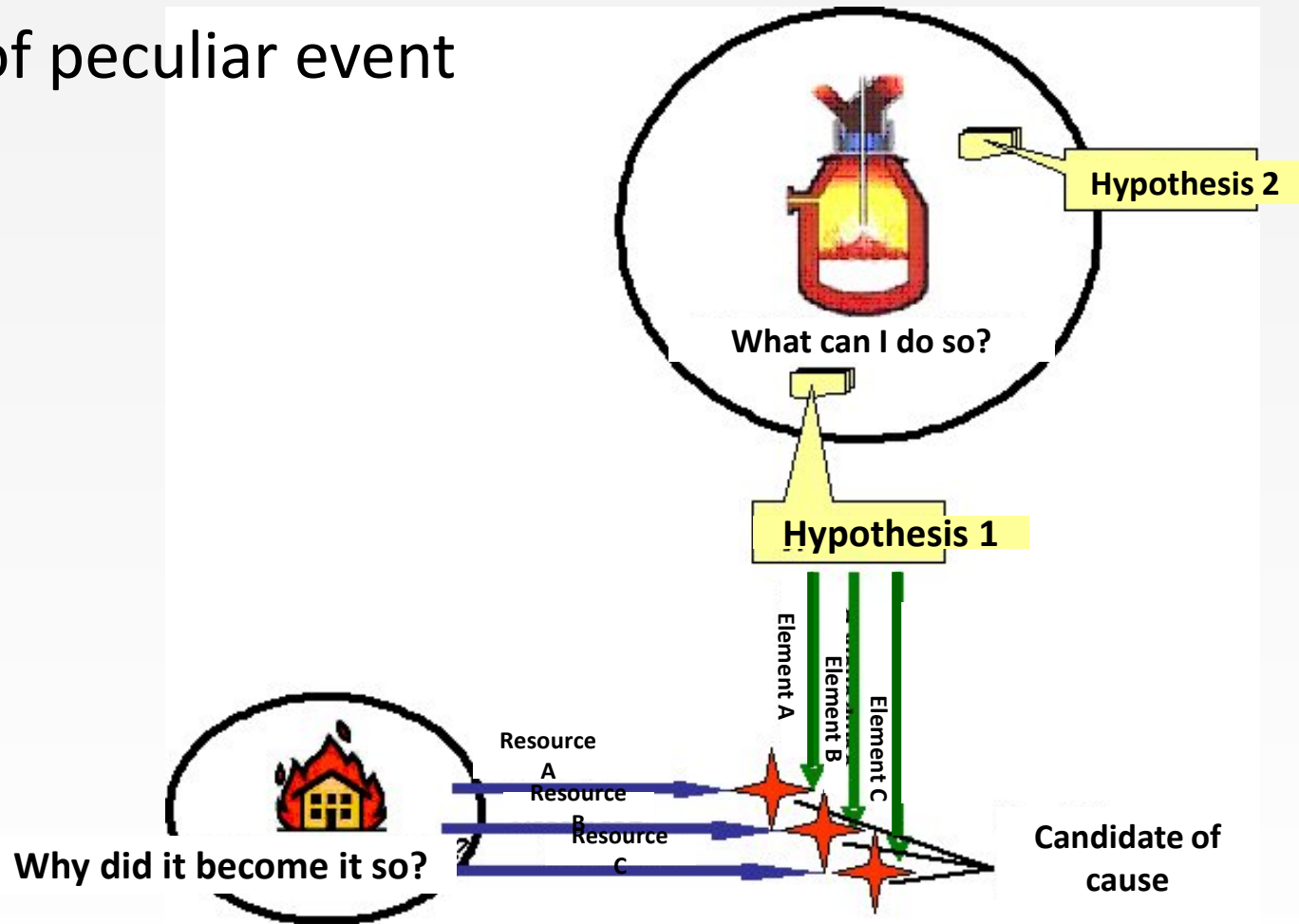
- ① The method of causing the same natural phenomenon as trouble is invented (IPS).
- ② The natural phenomenon is pulled and an already-known excessive scientific method is dug up.
- ③ The method where it generates it by a profitable purpose is retrieved.



# Step 3: Verify resources

Which of two or more hypotheses a true cause is specified.

- ① Fulfillment of resource
- ② Verification of peculiar event
- ③ Proving test

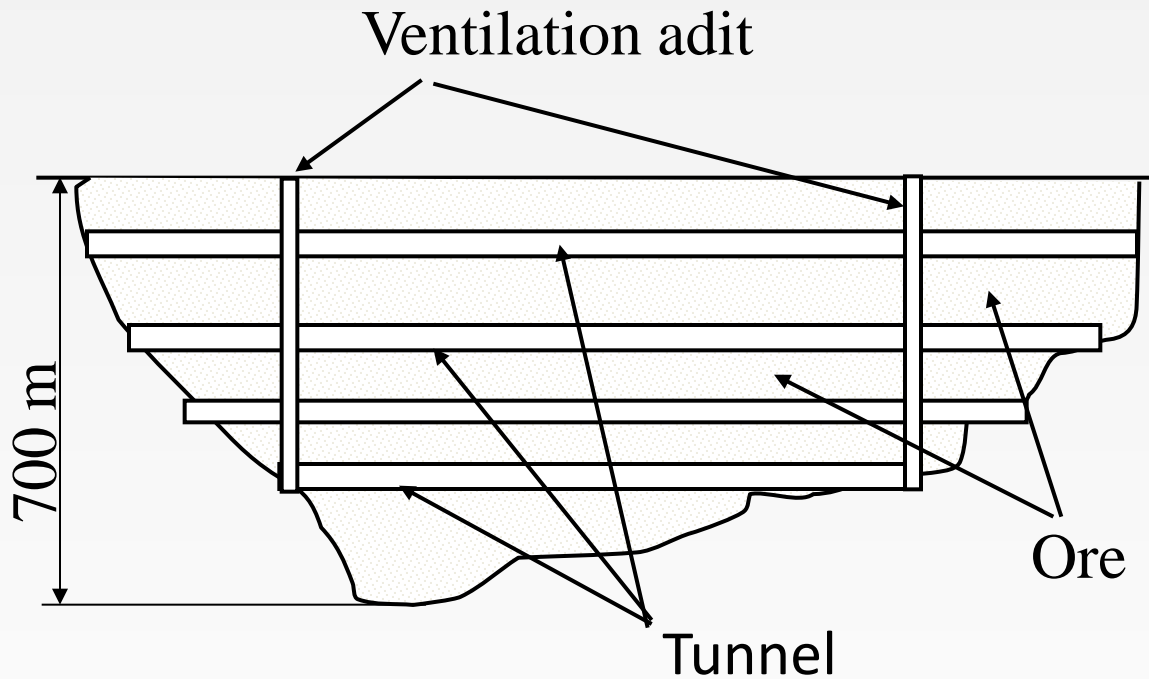


---

## 4. CASE INTRODUCTION

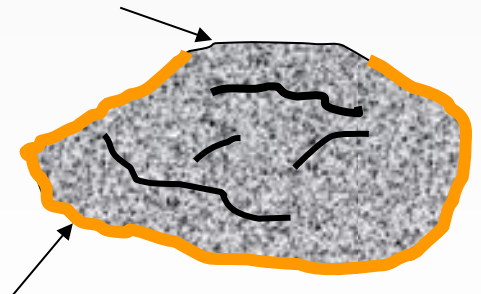


# Rocks crumble from the ceiling of the tunnel in the mine



◆ The rock drops in a specific, two or more zones. It doesn't occur at all in other zones.

◆ New surface 15 20-%

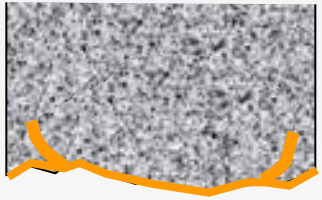


◆ Oxidized surface

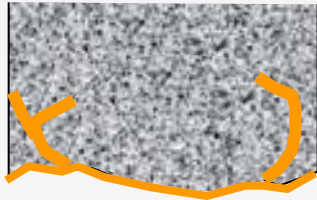
## Step 1: Problem inversion

How is the stone dropped?

T1



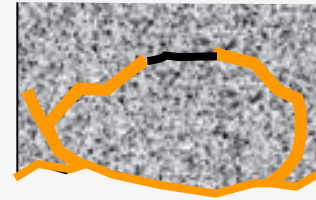
T2



T3



T4



T5

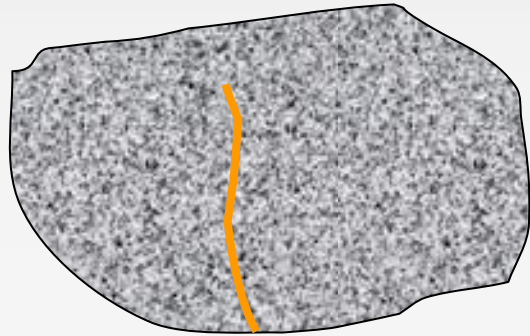


## Step 2: Trouble hypothesis

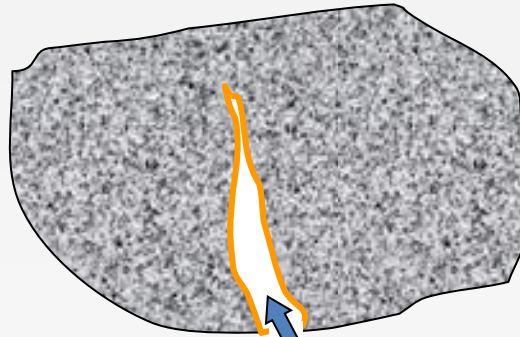
The crack is developed and it is oxidized.

# Inversion of the new problem

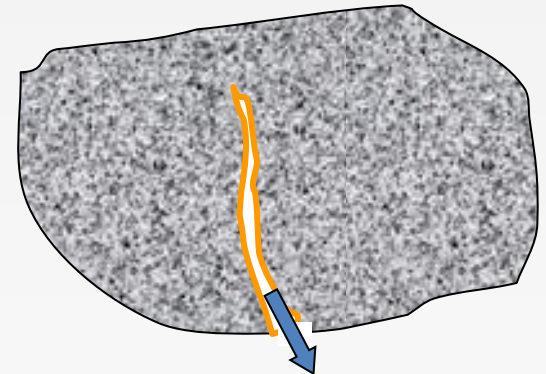
How is the crack developed?



Crack

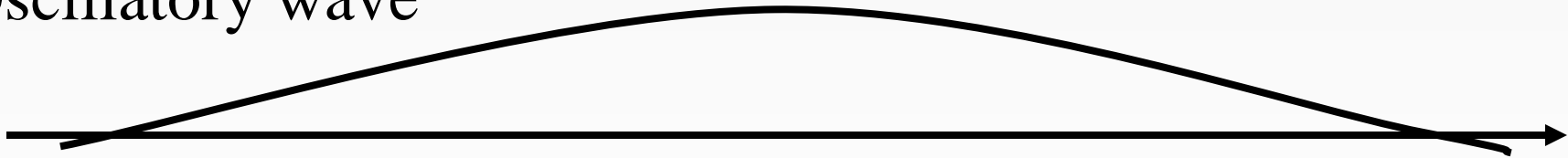


Air enters and the crack opens.



Air goes out and the crack shuts.

Oscillatory wave

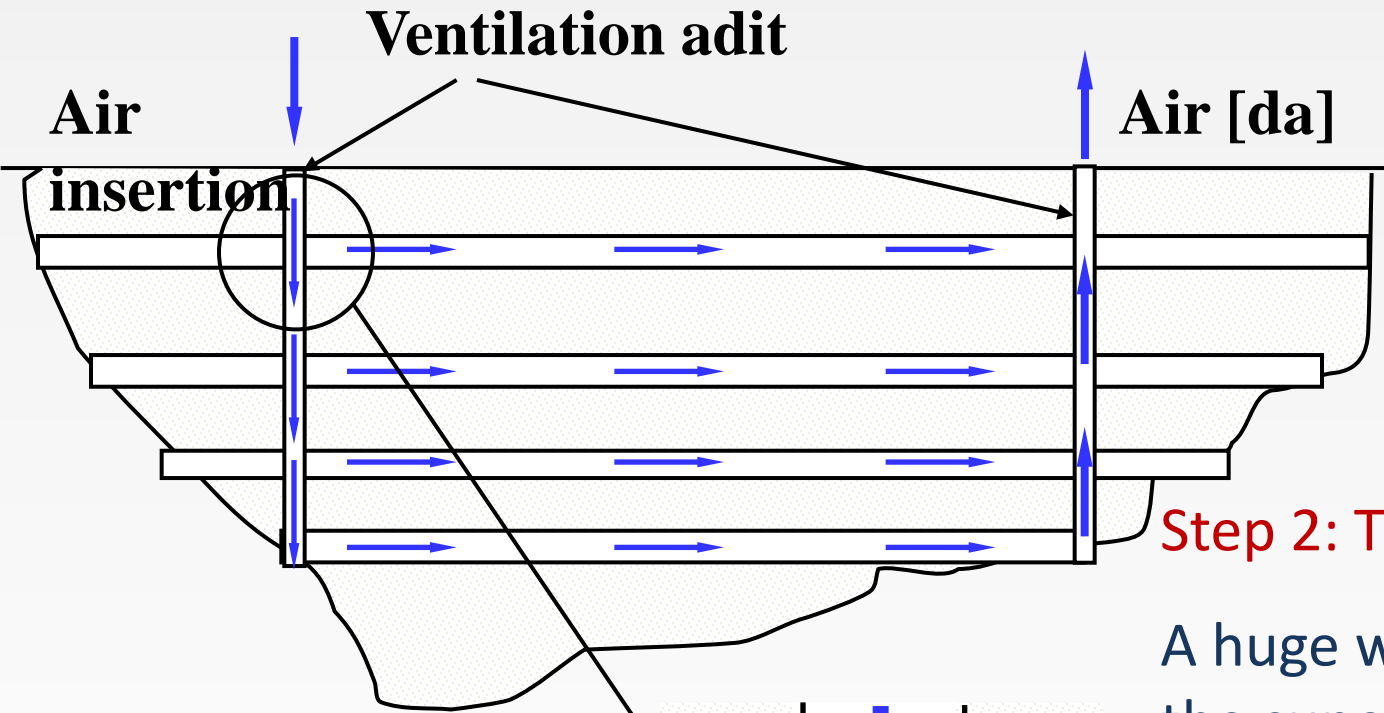


Step 2: Trouble hypothesis

The opening and shutting of the crack (breath) is repeated by the aerial vibration.

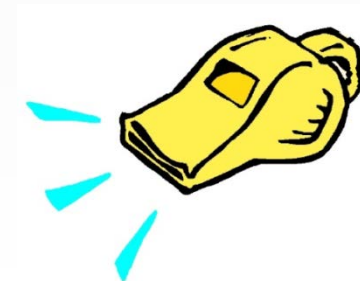
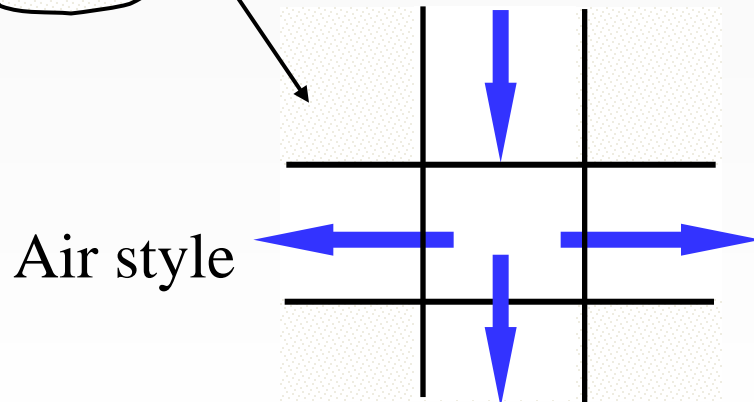
# Step 1: Inversion of the new problem

How is the crack developed?



Step 2: Trouble hypothesis

A huge whistle generates the supersonic wave.

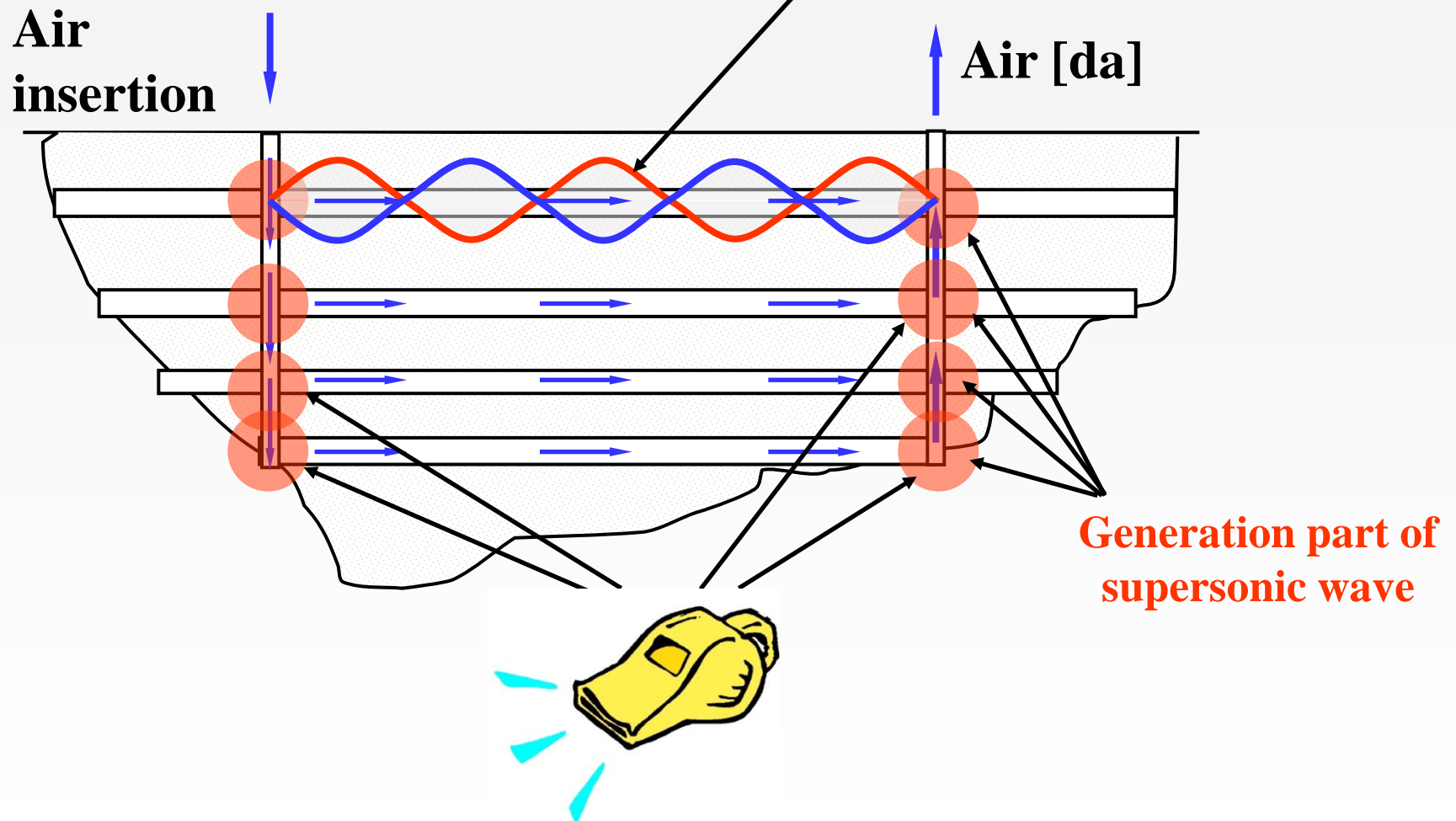


# Step 1: Inversion of the new problem

How is the vibration caused in a specific zone?

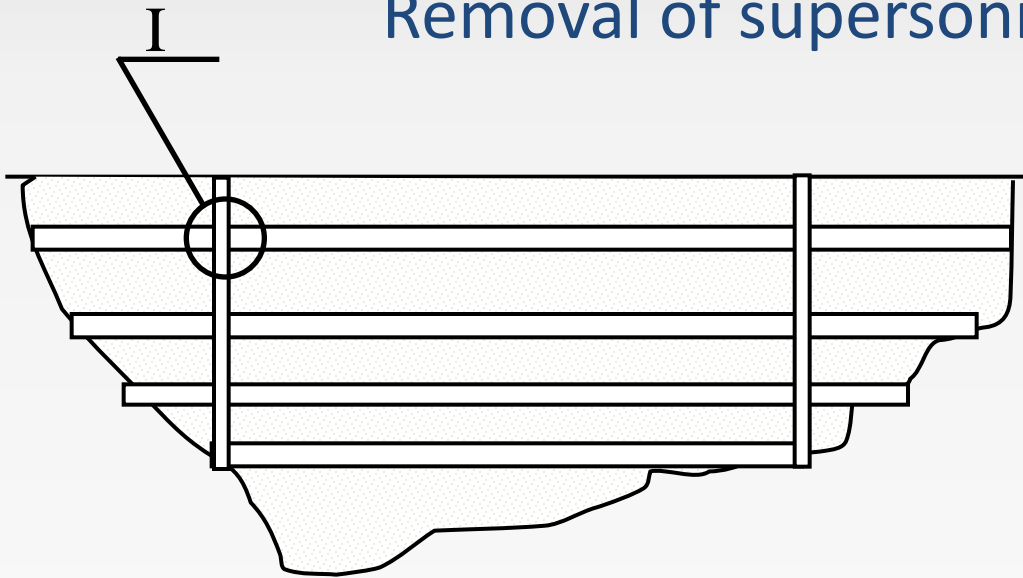
## Step 2: Trouble hypothesis

The round trip of the supersonic wave forms the standing wave.



# Solution of trouble

## Removal of supersonic wave whistle



The corner in the tunnel that corresponds to the shifting plank of the whistle is shaved off.

