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Headquarters
Washington, DC 20546-0001

January 12, 2026

Reply to attn. of: Office of Communications
History and Information Services Division

Re: FOIA Tracking Number **26-00032-F-HQ**

This responds to your Freedom of Information Act (FOIA) request to the National Aeronautics and Space Administration (NASA), dated October 25, 2025, and received in this office on October 27, 2025. You seek:

A copy of the SLIDES for each of these NESC Academy (NASA Engineering and Safety Center) videos. The SLIDES are locked on the website so they cannot be viewed by the public.
A copy of the SLIDES and VIDEOs for parts 2 and 3 listed in item 12 below.

1) Lunar Landing
https://nescacademy.nasa.gov/video/427d8334fa41482797cae5cddf7d71a41d

2 and 3) Selected Apollo & Shuttle Lessons Learned ({Parts 1 and Part 2)
https://nescacademy.nasa.gov/video/9edb3c4de48e46d7b66f2a91ace96a171d
https://nescacademy.nasa.gov/video/27784b7aa2ce4c628d77143c86232d621d

(4, 5, 6 and 7) Failure Recovery (Parts 1, 2, 3 and 4)
https://nescacademy.nasa.gov/video/9efbd739aeae4da6b8a80b7370ccff051d
https://nescacademy.nasa.gov/video/4e202def3eb943c99e4ba2744676392c1d
https://nescacademy.nasa.gov/video/9965475c1f2649c4a56aad45cbc553ab1d
https://nescacademy.nasa.gov/video/44323a56200341a198d3911002f0eb211d

8, 9 and 10) Lessons Learned from Fifty Years of Observing Hardware and Human Behavior, Parts 1, 2 and 3
https://nescacademy.nasa.gov/video/c81ccbfd7909415ea72070bbf1c8e38f1d
https://nescacademy.nasa.gov/video/e84a2cc167244d14ac623358f2e9526a1d
https://nescacademy.nasa.gov/video/79e6fd6fc7544b0ba7525f31ed2d866e1d

11) Using TRIZ for Engineering Innovation *https://nescacademy.nasa.gov/video/a42a19ce39a14cd49dfb669e774812b71d*

12) Orion Landing Attenuation: slides for Part 1, Part 2, and Part 3. Copy of the video presentation for Part 2 and Part 3
https://nescacademy.nasa.gov/video/806485bdd20041cda2445409cf5737e21d

In response to your request we conducted a search of NASA's Langley Research Center, Engineering and Safety Center (NESC) using the information from your request. NASA's search began on November 18, 2025 and any records created after this date are not included with this response. That/Those search(es) identified the enclosed records that are responsive to your request. We determined that all **533** pages and 2 videos (Orion Part 2 - 55 minutes, 42 seconds; Orion Part 3 - 47 minutes, 52 seconds) are appropriate for release without excision and copies are enclosed.

Appeal

If you believe this to be an adverse determination, you have the right to appeal my action on your request. Your appeal must be received within 90 days of the date of this response. Please send your appeal to:

Administrator
NASA Headquarters
Executive Secretariat
ATTN: FOIA Appeals
MS 9R17
300 E Street S.W.
Washington, DC 2054

Both the envelope and letter of appeal should be clearly marked, "Appeal under the Freedom of Information Act." You must also include a copy of your initial request, the adverse determination, and any other correspondence with the FOIA office. In order to expedite the appellate process and ensure full consideration of your appeal, your appeal should contain a brief statement of the reasons you believe this initial determination should be reversed. Additional information on submitting an appeal is set forth in the NASA FOIA regulations at 14 C.F.R. § 1206.700.

Assistance and Dispute Resolution Services

If you have any questions, please feel free to contact me at derek.m.moore@nasa.gov. For further assistance and to discuss any aspect of your request you may also contact:

Stephanie Fox
FOIA Public Liaison
Freedom of Information Act Office
NASA Headquarters
300 E Street, S.W., 5P32
Washington D.C. 20546
Phone: 202-358-1553
Email: Stephanie.K.Fox@nasa.gov

Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services it offers. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, e-mail at ogis@nara.gov; telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

Important: Please note that contacting any agency official including myself, NASA's FOIA Public Liaison, and/or OGIS is not an alternative to filing an administrative appeal and does not stop the 90 day appeal clock.

Sincerely,

Derek Moore

Derek Moore
Government Information Specialist

Lesson 10: Using TRIZ for Innovation

Dr. Sven G. Bilén

Themes Addressed

Return to Flight Experience

Dr. Sven G. Bilén

Importance of Innovation

- Why is innovation in design important?
- What words are synonymous with innovation?
  - What is difference between creativity & innovation?
  - Innovation refers to learnable processes by which improvements & inventions achieved
- What is importance of innovation to NASA?
- What are some examples of “innovative” products or solutions?

Dictionary Definitions

in·no·va·tion (ĭn'ə-vā'shən)

n.

1. Act of introducing something new
2. Something newly introduced

cre·a·tive (krē-ā'tĭv)

adj.

1. Having ability or power to create: *Human beings are creative animals*
2. Productive; creating
3. Characterized by originality & expressiveness; imaginative: *creative writing*

n.

One who displays productive originality: *the creatives in the advertising department*

Dieter* Engineering Design Steps

Conceptual design

Define problem
Problem statement, benchmarking, QFD, PDS, project planning

Gather information
Internet, patents, trade, literature

Concept generation
Brainstorming, functional decomposition, TRIZ, morphology chart

Evaluation of concepts
Pugh concept. selection, decision matrices

Embodiment design

Product architecture
Arrangement of physical elements to carry out function

Configuration design
Preliminary selection of materials & manufacturing, modeling & sizing

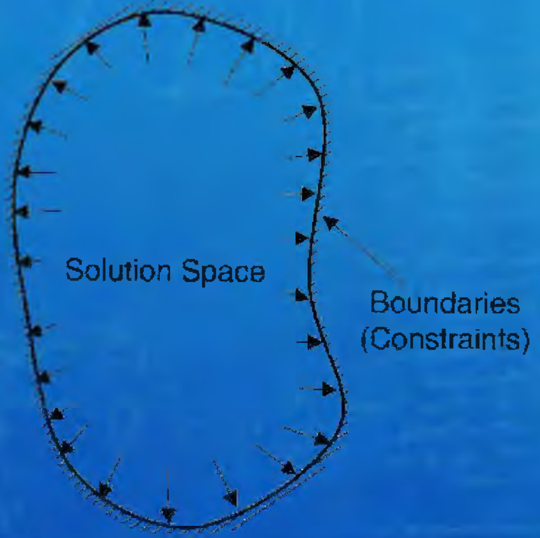
Parametric design
Robust design, tolerances, final dimensions, DFM

Detail design
Detailed drawings & specifications

*George E. Dieter

Creativity Methods Mindset

- Suspend judgment
- Creative attitude ("thinking out of the box")
  - Maybe should "increase the size of the box"
- Persistency
- Open mind (avoid NIH: "not invented here")
- Set boundaries (proper definition focuses, not limits, creativity)
  - However, set boundaries as large as possible



Creativity Methods

- Brainstorming
- SCAMPER:
  - Substitute, Combine, Adapt, Modify, Put to other uses, Eliminate, Rearrange
- Fishbone diagrams
  - Ishikawa diagrams: named after Kaoru Ishikawa, Japanese quality pioneer (1st used technique in 1960s)
  - Cause-&-effect diagrams
- 6-3-5 method
  - 6 people, 3 ideas, 5 minutes

- Biomimetics
  - Field of science that tries to decipher, mimic & adopt natural processes for potential use in technology applications

Activity 10-1

Polling the Participants

In a formal way, which of these creativity methods have you used at work?

0%	a.	Brainstorming
0%	b.	SCAMPER
0%	c.	Fishbone
0%	d.	6-3-5
0%	e.	Biomimetics
0%	f.	None

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

Answer Now

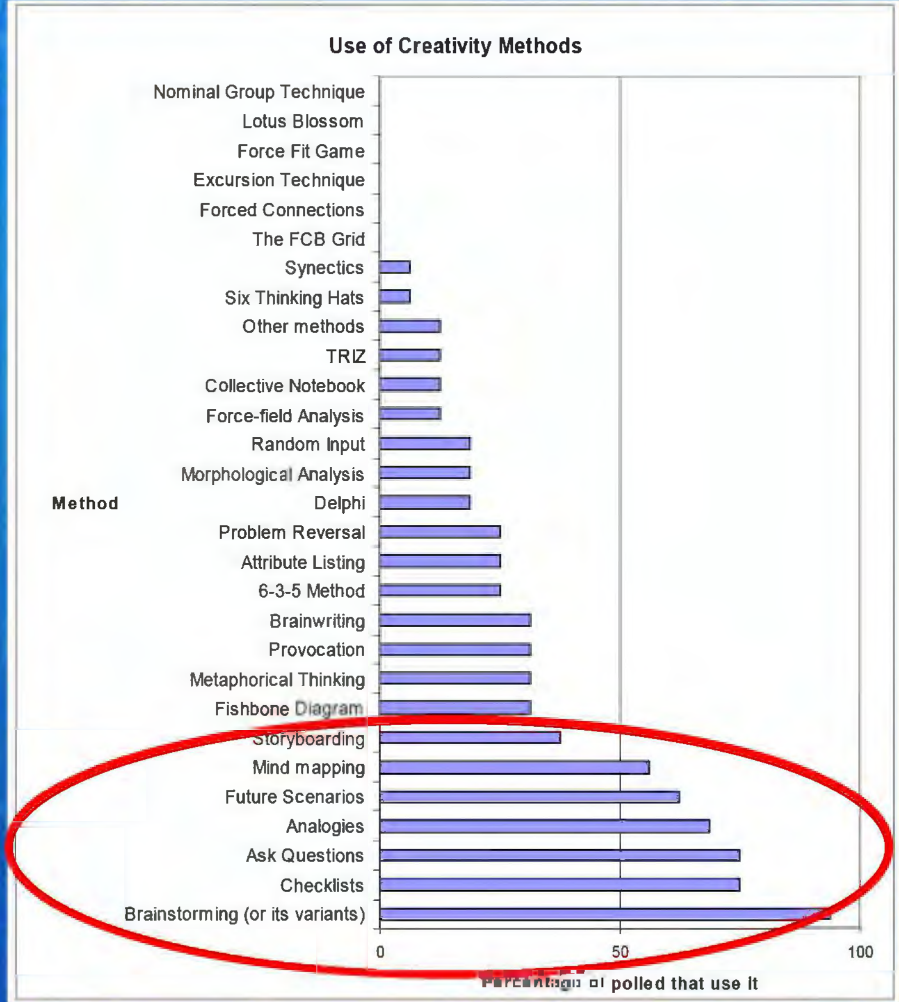
10

Creativity Methods in Use

Reported use of methods within companies

Many different methods used

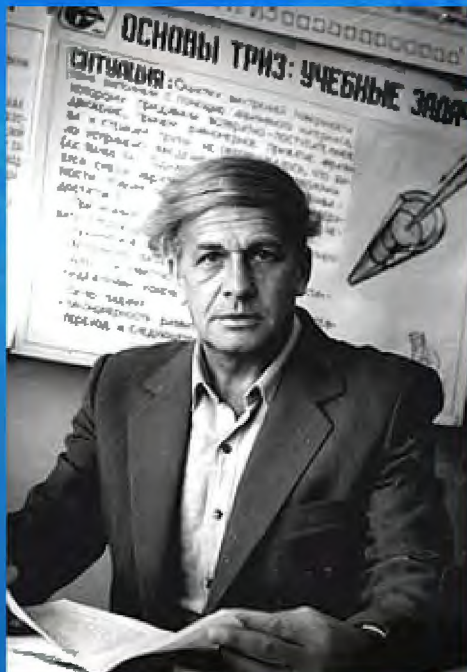
Most rely on "internal" knowledge methods



What Is TRIZ?

- Method for solving technical problems based upon studies of world's most inventive patents
- Superior method for defining both *technical* & *organizational* problems in way that clearly shows most productive areas for concentrated effort
- Process for producing both innovative & exhaustive solution set
- Process that takes luck & guesswork out of creativity & invention

TRIZ



Genrich Saulovich
Altshuller,
father of TRIZ

- Theory of inventive problem solving (Russian acronym)
- Altschuller (1946) studied 1.5 million patents
  - 75% routine or minor improvement
  - 20% resolve contradictions – TRIZ
  - 4% new scientific principle – TRIZ
  - <1% rare scientific discovery
- Developed set of inventive principles that formed core of TRIZ
- Large number of TRIZ tools since been developed
- TRIZ focuses on
  - Technical contradictions & contradiction matrix
  - Physical contradiction & separation principles
  - Standard solutions

Levels of Invention/Innovation

Moving to higher levels of innovation

Level 5: Discovery

Level 4: Invention outside paradigm

Level 3: Invention inside paradigm

Level 2: Improvement

Level 1: Apparent solution (no innovation)

39 Engineering Parameters Engineers Typically Try to Improve

- Weight of moving object
- Weight of nonmoving object
- Length of moving object
- Length of nonmoving object
- Area of moving object
- Area of nonmoving object
- Volume of moving object
- Volume of nonmoving object
- Speed
- Force
- Tension, pressure
- Shape
- Stability of object
- Strength
- Durability of moving object
- Durability of nonmoving object
- Temperature
- Brightness
- Energy spent by moving object
- Energy spent by nonmoving object
- Power
- Waste of energy
- Waste of substance
- Loss of information
- Waste of time
- Amount of substance
- Reliability
- Accuracy of measurement
- Accuracy of manufacturing
- Harmful factors acting on object
- Harmful side effects
- Manufacturability
- Convenience of use
- Repairability
- Adaptability
- Complexity of device
- Complexity of control
- Level of automation
- Productivity

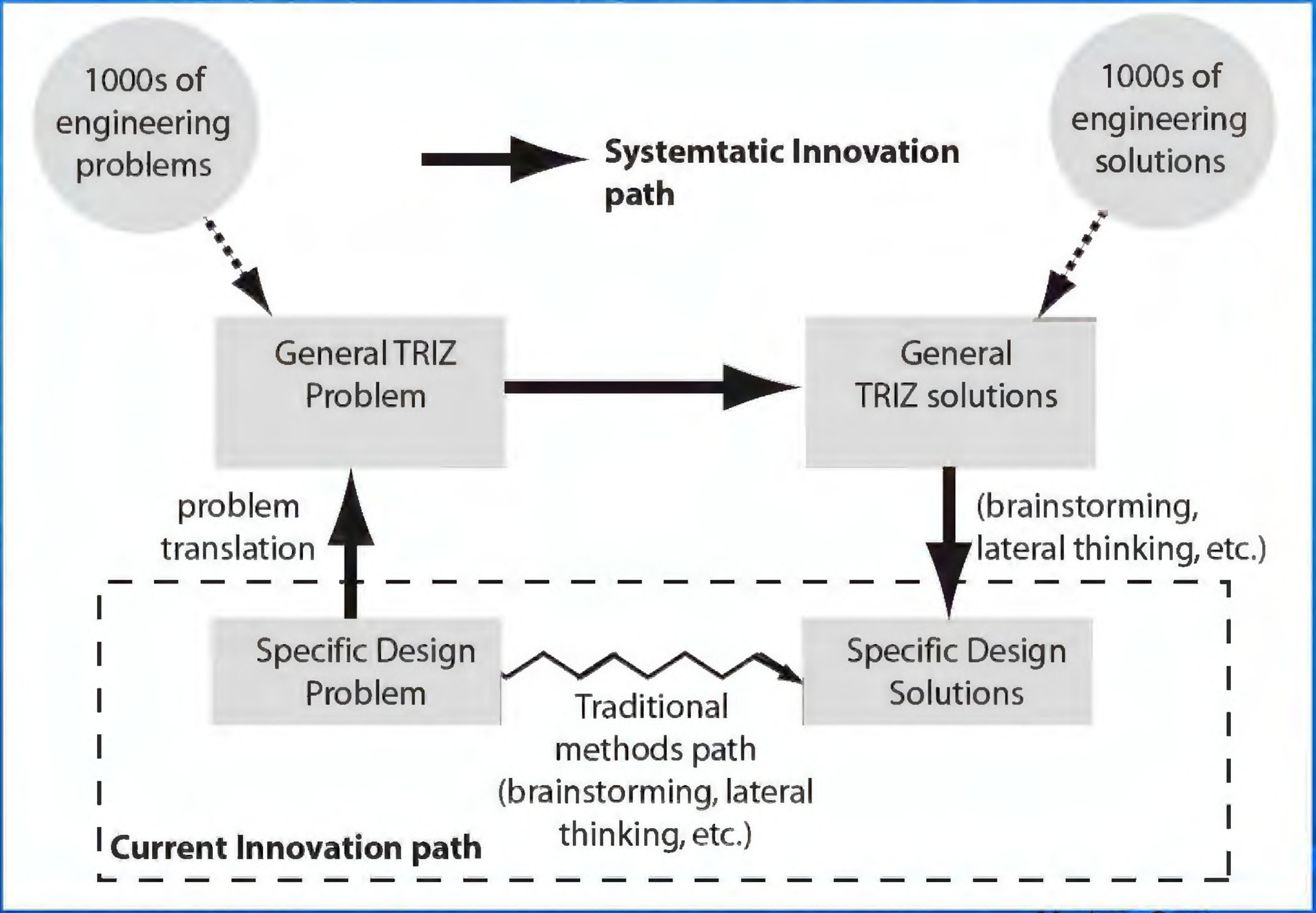
40 Design Principles

- Altschuller reformulated problems found in patents in terms of 39 general engineering parameters
  - What began to emerge is: Nearly all solutions in patents could be condensed to 40 design principles
- If most design principles to thousands of problems can be condensed to 40 principles, reverse should be true → For current design problem, 40 principles can be used to find design solution

Patterns of Invention/Innovation

- Realized fundamental problem ("contradiction") solved by inventions in different areas of technology
- Observed same fundamental solutions used over & over again, often separated by many years
- Reasoned if latter innovator had knowledge of earlier solution, task would have been straightforward
- Sought to extract, compile & organize such information

TRIZ Innovation Path



Madara Ogot

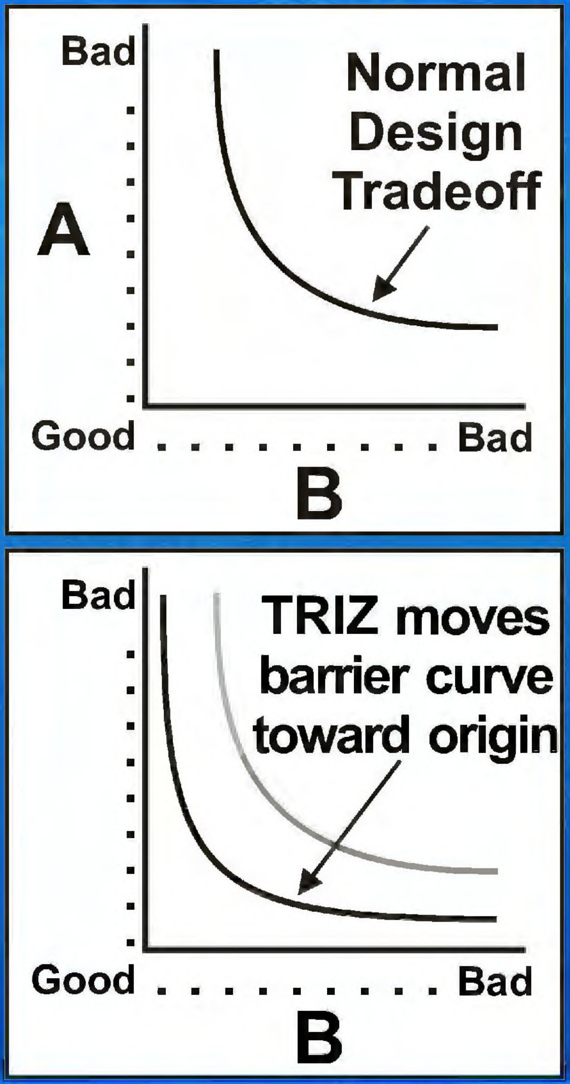
TRIZ Model

- Generic inventive principles applied to all other areas of technology, reducing time to produce breakthrough ideas & inventions
- Does problem, process, or product appear to have irresolvable contradiction in design or operation?
- Chances are this same contradiction has been & solved before—by people in other industries or technologies
- Don’t have time to follow all world’s literature & patents
- TRIZ inventive principles & historical study of great inventions teach us that direct confrontation & resolution of contradictions are keys to breakthrough inventions & ideas

Examples of Tradeoffs → Contradictions

- Safety of car vs. fuel efficiency → heavy car vs. light car
- Size of organization vs. speed of response
- Pill bottle safety protection vs. ease of opening
- Wound coverage vs. ability of wound to "breathe"
- Rapid access to information vs. security concerns
- Pressure security of pipe or vessel vs. number of bolts required to open

Power of TRIZ



- Normal design compromises on these contradictions & moves along design-tradeoff curve
- TRIZ inventive principles moves curve toward origin

Why Are Good Ideas Rejected?

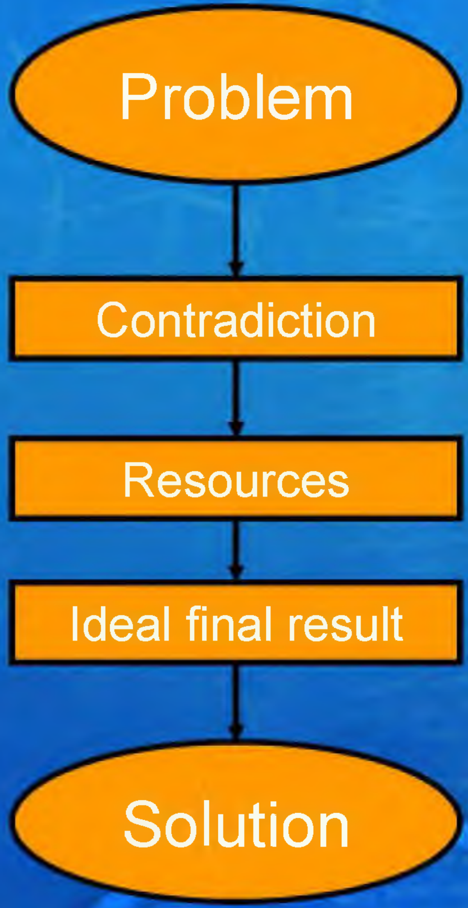
- Think of examples of ideas that took a while to get implemented
  - Inventor seldom a good salesperson
  - Lack of support from management
  - Poor presentation of idea
  - Prejudices or “paradigm paralysis”
  - NIH (not-invented-here) syndrome
- What if all these issues are adequately addressed?

Two Positions

- 20/20 hindsight: easy to see idea was good after fact, but impossible to know if good or bad when first proposed
- Learn from past: patterns of evolution can be discovered & used to get better solutions→TRIZ

Common Features of Good Solutions

- Resolves contradictions
  - Tradeoff contradiction: if something good happens, something bad happens
  - Inherent contradiction: want something that has 2 opposite properties
- Uses idle, easily available resources
  - Unseen or idle resources of system used to reach incompatible goals
- Increases "ideality" of system
  - "Ideal final result": has all benefits, at no cost, with no harmful effects



Reorganization of Creative Activity

- Old way of working
  - Trial & error
  - Contradictions hidden
  - Adding resources
  - Compromise
  - Evolution considered accidental

- New way of working
  - Systematic work
  - Contradictions clarified
  - Using available resources
  - Ideal final result
  - Knowledge of patterns of evolution

Constructing New Model for Problem Solving

Moving from *Problem* to
Ideal Final Result

Contradiction

- Early insight: Solving problem means removing contradiction
- Contradiction: conflict in system
- System consists of 2 components: tool & object

If blade made heavier, can strike more effective blow, but more awkward to swing

Resources

- Resources are things, information, energy, properties of materials, etc., for solving contradictions
- Often invisible at first because not accustomed to seeing them when we look at a problem

Resources in ax & chunk of wood

- Blade, its edge, its form, its material & other properties
- Chunk of wood & its properties
- Surrounding air, etc.

Ideal Final Result (IFR)

- Using resources, remove contradiction & get IFR
- "Ideality" measures how close system is to IFR. If:
  - Useful feature improves, ideality improves
  - Harmful feature decreases, ideality improves

IFR Statement

"*Resource* will eliminate *negative effect* within *operating zone* during *operating time* without complicating system while performing the *positive effect*"

- Used to capture problem you are trying to solve
- Intentionally avoids inclusion of features in current design (if 1 exists) to avoid biasing design process in any particular direction

What Solution Exists

IFR: something changes axe in some way so that it is both heavy & light to make its blow stronger without decreasing ease of use

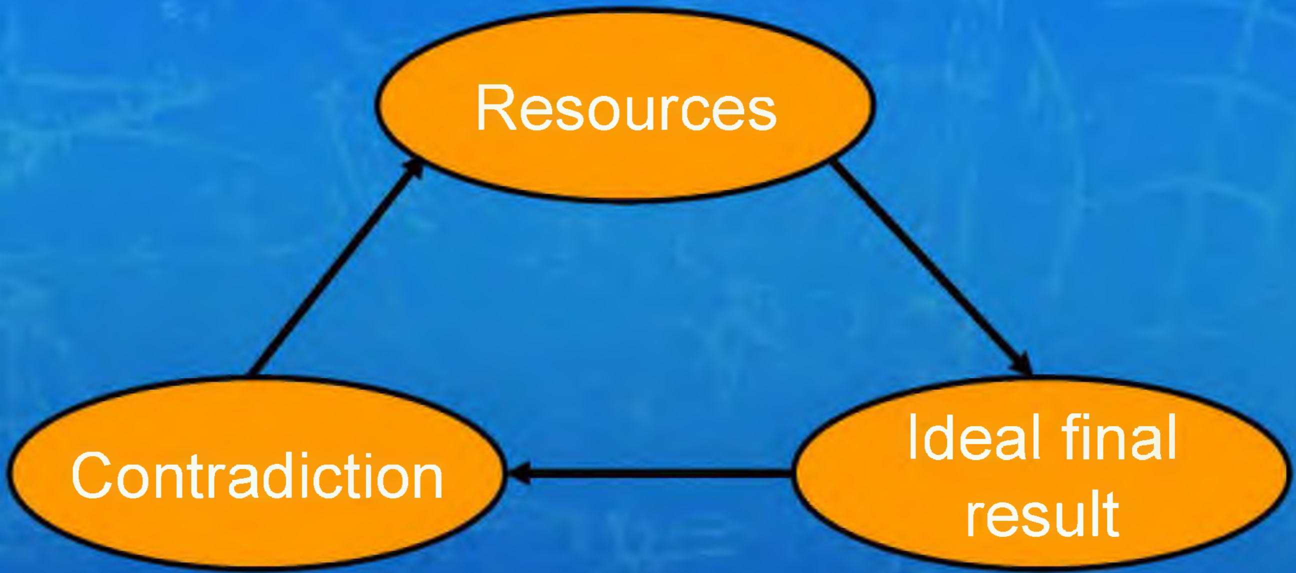
What are some ways/methods to solve this contradiction?

Use air as resource: make something solid hollow

Other TRIZ Ways of Thinking

- Clarify tradeoff behind problem
- Move from tradeoff to inherent contradiction
- Map invisible resources
- Increase solution ideality

Improvement Cycle



Repeating process speeds up development project & improves result

Patterns As a Tool

- Same patterns are repeated in evolution of systems
  - Use them to further development of system
- 5 primary patterns of evolution
  - Uneven evolution of technology
  - Transition to macrolevel
  - Transition to microlevel or segmentation
  - Increase of interactions
  - Expansion/convolution or trimming
- Use patterns for selecting solutions, solving problems, forecasting solutions, transferring solutions across industries

40 Inventive Principles

40 Inventive Principles to Overcome Contradictions (1–10)

1. Segmentation
2. Extraction/taking out
3. Local quality
4. Asymmetry
5. Combining/merging
6. Universality
7. Nesting
8. Counterweight/anti-weight
9. Prior counteraction/preliminary anti-action
10. Prior action/preliminary action

40 Inventive Principles to Overcome Contradictions (11–20)

11. Cushion in advance/beforehand cushioning
12. Equipotentiality
13. Inversion/“the other way round”
14. Spheroidality/curvature
15. Dynamicity
16. Partial or overdone/excessive action
17. Moving to new dimension
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action

40 Inventive Principles to Overcome Contradictions (21–30)

21. Rushing through/skipping
22. Convert harm into benefit/“blessings in disguise”
23. Feedback
24. Mediator/intermediary
25. Self-service
26. Copying
27. Inexpensive, short-lived object for expensive, durable 1
28. Replacement of mechanical system
29. Pneumatic or hydraulic construction
30. Flexible membranes/shells or thin film

40 Inventive Principles to Overcome Contradictions (31–40)

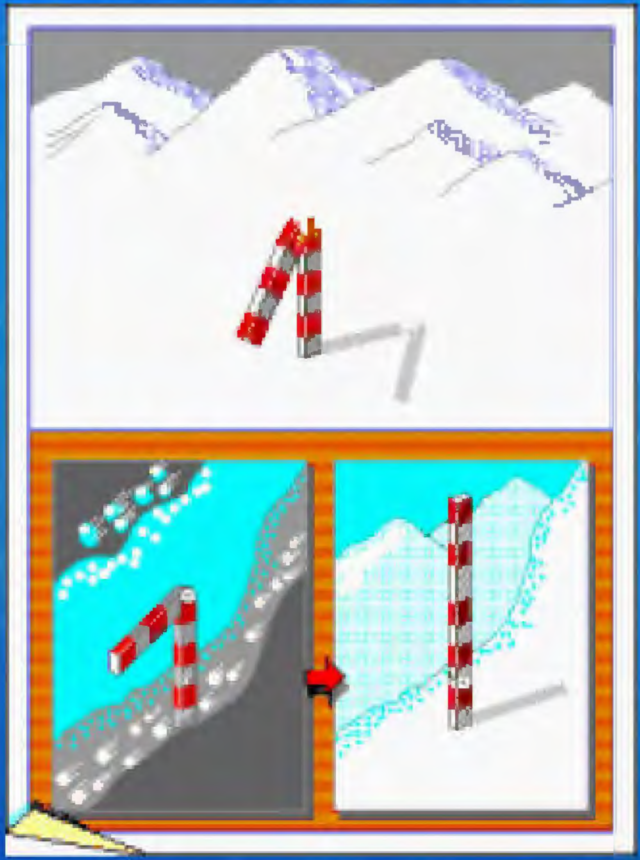
31. Use of porous material
32. Changing color
33. Homogeneity
34. Rejecting & regenerating parts
35. Transformation of physical & chemical states of object/parameter changes
36. Phase transformation
37. Thermal expansion
38. Use strong oxidizers
39. Inert environment/atmosphere
40. Composite materials

Segmentation Examples

Invention # 1. Measuring snow depth

Snow depth can be measured by fixing pole vertically into ground. Pole is susceptible to damage, however

Pole can be “segmented” by incorporating hinge into its design. Instead of resisting avalanche, the hinged pole bends, then returns to its previous position

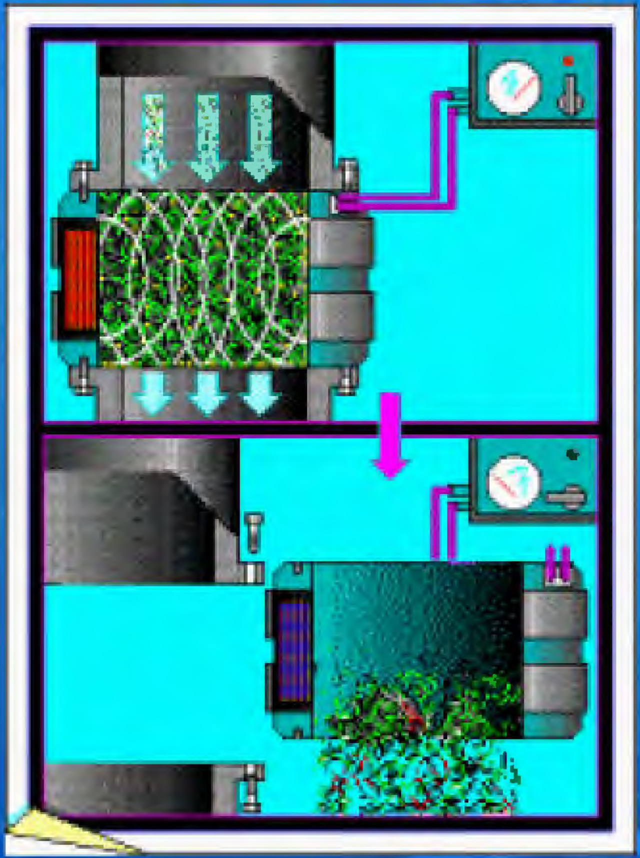


Segmentation Examples

Invention # 2. Easy-to-clean filter

To clean hot gas flow of nonmagnetic dust, flow was passed through filter consisting of multiple layers of metallic cloth. This filter was difficult to clean, however

Filter made of a porous structure of ferromagnetic granules held together by magnetic field can be used instead. To clean this filter, magnetic field is switched off—filter crumbles & can be easily cleaned, then reconstituted



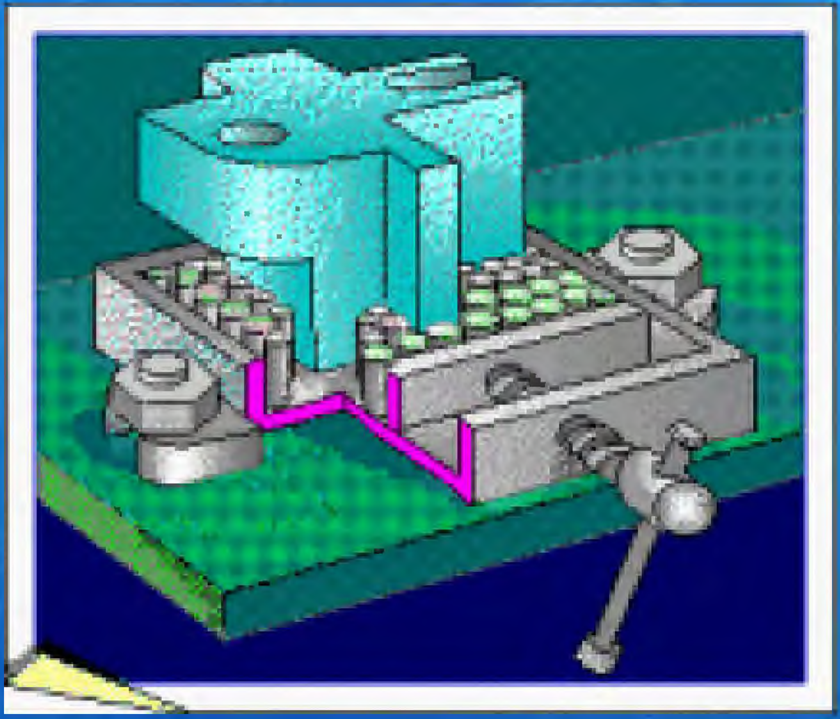
www.ideationtriz.com

Segmentation Examples

Invention # 3. Gripping workpieces of complex shape

To grip workpieces of complex shape, vice jaws must have corresponding shape. It is expensive to produce a unique tool for every workpiece, however

This problem can be solved by placing multiple hard bushings around workpiece. Bushings can move horizontally to conform to necessary shape



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40 Inventive Principles to Overcome Contradictions

- Physical contradiction—element of system is subject to 2 opposing requirements
- Technical contradiction—improvement in 1 engineering parameter deteriorates another
- Technical contradiction matrix
  - Engineering parameter vs. engineering parameter (roof of QFD)
  - In intersection, list inventive principles that may resolve contradiction
- Algorithm of inventive problem solving (ARIZ)
  - Search for concepts using contradiction table
  - If no acceptable solution, look at physical contradictions
  - Separate opposing requirements in time, space (absorber), between system & its components
  - Knowledge base of physical effects (average engineer knows 50–100 out of 6,000)

Resources

- Creativity methods listed & described
  - *www.mycoted.com*
- TRIZ journal
  - *www.triz-journal.com*
- The TRIZ Experts
  - *www.trizexperts.net*
- Altschuller Institute
  - *www.aitriz.com*
- Ideation TRIZ
  - *www.ideationtriz.com*

Caveats

- TRIZ is not "magic bullet"
- Use right creativity tool to fit design challenge
- TRIZ is more complicated & takes longer to master than other techniques
- Even without full TRIZ implementation, concept of inherent contradiction, resource identification & ideal final result are powerful