AATRIZINVENTOR SOLUTION FOR INNOVATION BASED ON NATURE'S L.I.
Working Document to Build a Specific Solution.

INNOVATION CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

APLICATION OF NATURE'S LANGUAGE OF INNOVATION / Nature's L.I.
Web site: www.aatrizinventor.com
Reference book: The Nature's Language of Innovation, José Roberto Espinoza, Amazon, Kindle.

FACTORS OF INNOVATION:
FUNCTION AFFECTED: Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility
PHYSICAL VARIABLE OR CHARACTERISTIC: Less Ability to deground
S1 OBJECT: GROUNDED CARGO SHIP Type: Moving
S2 OBJECT: SUEZ CANAL SEAFLOOR Type: Stationary
DESIRED ACTION VERB: Improve

INNOVATION CHALLENGE:
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility
DESIRED GOAL: More Ability to deground
EVALUATED OBJECT: GROUNDED CARGO SHIP
NEED TO SATISFY > 27. Reliability

SELECTED INNOVATION PARAMETERS TO EVALUATE:
A. UNDESIRABLE EFFECTS CAUSES OF DISSATISFACTION (UDEs)
There are More difficulty to Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility because:
GROUNDED CARGO SHIP Has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
GROUNDED CARGO SHIP Has More Own length or relative distance, whether physical or figurative interacting with S2
GROUNDED CARGO SHIP Has More Pressure or tension interacting with S2
GROUNDED CARGO SHIP Has More Harmful factors affecting it by interacting with S2
There are undesirable effects that cause dissatisfaction because:
There is Less Ability to deground
B. DESIRED EFFECT FOR NEED TO SATISFY
There is More ease to Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility because:
GROUNDED CARGO SHIP Has More Desired reliability to interact with S2
There is desirable effect for need to satisfy because:

There is More Ability to deground

Table I. RELATIONSHIP WITH UNIVERSAL TRIZ INNOVATION PARAMETERS (maximum of 7 undesirable effects)
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

This table presents the selected innovation parameters to evaluate the challenge that must be resolved for the interaction between an Object S1 and an Object S2, and no others. The choice of undesirable effects must be based on a thorough review of the current situation, identifying them based on the objective evidence present within the predefined space and time of evaluation. Fulfilling this requirement is crucial: If you do not connect the dots of the current situation properly, the algorithm will deliver a disconnected solution.
The selection of the need to satisfy should reflect the best estimation of the innovation-evolution state of the object S1 being evaluated.
Recognizing the criticality of this selection process, the Aatrizinventor algorithm provides flexibility to change parameters and conducts a sensitivity analysis in order to offer alternative solutions. These alternatives are based on different combinations of the entered parameters, also including a different need to satisfy from the one originally posed.

Parameters to evaluate(s)	**It is understood as GROUNDED CARGO SHIP has:**
Parámeters of undesirable effects (UDE):	**Undesirable effects causes of dissatisfaction:**
(+) 1. Heaviness of moving object	More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
(+) 3. Length of moving object	More Own length or relative distance, whether physical or figurative interacting with S2
(+) 11. Pressure/ Tension	More Pressure or tension interacting with S2
(+) 30. Object-affected harmful factors	More Harmful factors affecting it by interacting with S2
Desirable parameter (DE):	**Desirable Effect for Need to satisfy:**
(+) 27. Reliability	More Desired reliability to interact with S2
TRIZ undesirables parameters for sensitivity analysis	**It is understood as GROUNDED CARGO SHIP has:**
(+) 5. Area of moving object	More Own area or two-dimensional scope interacting with S2
(-) 9. Speed	Less Speed or rate of change interacting with S2
(-) 12. Shape / composition / configuration	Less Appropriate shape, composition, or configuration interacting with S2

n/a	
n/a	

EVALUTION RESULTS TABLES

TABLE II. SPECIFIC CONTRADICTION MATRIX FOR UNDESIRABLE EFFECTS AND NEED TO SATISFY. FOR EVALUATED OBJECT: GROUNDED CARGO SHIP AND NEED TO BE SATISFIED > 27. Reliability
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

(*) Preferred parameters: Improve 3. Length of moving object & Attenuate or preserve 30. Object-affected harmful factors.
Contradictions/ E.C: Essential, Comp.:Complementary, Top 5: Up to the major fifth, noted if outside the preferred parameters.
Parameters in the first row are the same as those in the first column.

Parameter to attenuate or preserve => Parameter to improve	Var.	(+) Par.1	(+) Par.3	(+) Par.11	**(+) Par.30 PREF.**	(+) Par.27	Sum wt
(+) 1. Heaviness of moving object	wt		wt.18	wt.13	**wt.8 Compl.**	**wt.5 Top 5**	57%
	IP(s)	0,0,0,0	15,8,29,34	10,36,37,40	22,21,18,27	1,3,11,27	
(+) 3. Length of moving object PREF.	wt	**wt.17 Compl.**		**wt.3 Compl.**	**wt.1 E.C.**	**wt.16 Compl.**	100%
	IP(s)	8,15,29,34	0,0,0,0	1,8,35,0	1,15,17,24	10,14,29,40	
(+) 11. Pressure/ Tension	wt	wt.13	**wt.4 Top 5**		**wt.11 Compl.**	wt.10	62%
	IP(s)	10,36,37,40	35,10,36,0	0,0,0,0	22,2,37,0	10,13,19,35	
(+) 30. Object-affected harmful factors	wt	wt.6	wt.19	wt.12		wt.15	49%
	IP(s)	22,21,27,39	17,1,39,4	22,2,37,0	0,0,0,0	27,24,2,40	
(+) 27. Reliability	wt	**wt.2 Top 5**	wt.20	wt.7	**wt.9 Compl.**		71%
	IP(s)	3,8,10,40	15,9,14,4	10,24,35,19	27,35,2,40	0,0,0,0	
Sum wt		71%	45%	71%	98%	55%	

This table shows the essential contradiction (E.C.) that determines the solution strategy. Additionally, preferred parameters are established where complementary contradictions (Compl.) are found, allowing the definition of the Base Solution shown in Table III.
As a complement to the Base Solution, Table II also provides the following information that could be relevant to obtain an optimal solution:
a) The algorithm identifies the top 5 contradictions from the entire Table II and highlights those that are outside the preferred parameters for further review.
b) There are inventive principles present in Table II that are not part of the Recommended Solution proposed in Table V. In the latter, the top three most relevant ones are highlighted, and the contradictions they involve are presented to evaluate whether they contribute significant aspects to the desired solution. For further details, Table VIII provides a prioritization of the inventive principles from Table II, and those not included in the Recommended Solution in Table V are marked with ***.

TABLE III. BASE SOLUTION FOR THE EVALUATED OBJECT: GROUNDED CARGO SHIP
NEED TO SATISFY > 27. Reliability
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

Table II Selection: Essential Contradiction wt.1 y Complementary contradictions with preferred parameters (*) wt.3/wt.8/wt.9/wt.11							
Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	Essential	wt.1	**1 Es.**	**15 Es.**	**17 Es.**	**24 Es.**
(+) 3. Length of moving object	(+) 11. Pressure/ Tension	Compl. 1	wt.3	**1 Es.**	8	35	0
(+) 1. Heaviness of moving object	(+) 30. Object-affected harmful factors	Compl. 2	wt.8	22	21	18	27
(+) 27. Reliability	(+) 30. Object-affected harmful factors	Compl. 3	wt.9	27	35	2	40
(+) 11. Pressure/ Tension	(+) 30. Object-affected harmful factors	Compl. 4	wt.11	22	2	37	0

Inventive Principles (IP) selected for the Base Solution
IP.1. Segmenting/ Integrating - strategic type
IP.15. Dynamics - strategic type
IP.17. Another Dimension or Field - tactical type
IP.24. Intermediary - tactical type
IP.8. Anti-Weight/ Compensation - tactical type
IP.35. Transformation / Parameter Changes - strategic type
IP.22. Convert harm in benefit - strategic type

IP.21. Skipping/ Avoiding - tactical type
IP.18. Mechanical Vibrations/ Energy Variations - tactical type
IP.27. Cheap Short-Living Objects - strategic type
IP.2. Taking out/ Adding - strategic type
IP.40. Composite Materials/ Conditions - **operative type**
IP.37. Useful Perceptible Change - **operative type**

Table III shows the essential contradiction, the one with the highest weight, plus the following 4 complementary contradictions in weight, which are located in the row and column of the preferred parameters selected in Table II. These contradictions are considered relevant for the solution and are described as the Base Solution in Table IX.
Keep in mind that all inventive principles selected for a solution must be evaluated according to the specific context of the contradictions in which they participate.
Inventive principles marked with 'Es.' correspond to inventive principles that belong to the essential contradiction.

TABLE IV. CONTRADICTION MATRIX COVERAGE FOR SOLUTION AMONG NEEDS TO SATISFY FOR EVALUATED OBJECT: GROUNDED CARGO SHIP, NEED TO BE SATISFY: 27. Reliability

Coverage is defined as the extent to which the inventive principles from Table II encompass the inventive principles from Table IV. If weighted coverage is higher, it has been observed that the obtained solution is more likely to have the lowest cost and the maximum benefit-to-cost ratio.

Parameter to improve	Parameter to preserve	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
27. Reliability	39. Productivity	1	35	29	**38 nT2**
27. Reliability	15. Duration of action of moving object	2	35	3	**25 nT2**
27. Reliability	33. Ease of operation	27	17	40	0
27. Reliability	34. Ease of change, repair or maintain	1	11 nT3	0	0
27. Reliability	32. Ease of achieving desired outcome	0	0	0	0
27. Reliability	19. Use of energy by moving object	21	11 nT3	27	19 nT3
27. Reliability	27. Reliability	0	0	0	0
27. Reliability	38. Extent of automation/ autonomy	11 nT3	13 nT3	27	0
27. Reliability	35. Adaptability or versatility	13 nT3	35	8	24

27. Reliability	13. Stability	0	0	0	0

Inventive Principles (IP) selected for the Solution of relevant Contradictions between Needs to Satisfy
IP.1. Segmenting/ Integrating - strategic tpe
IP.35. Transformation / Parameter Changes - strategic tpe
IP.29. Controllable Soft Variables - tactical type
IP.38. Strong or Quick Reactions - **operative type**
IP.2. Taking out/ Adding - strategic tpe
IP.3. Local Quality - strategic tpe
IP.25. Self-service - **operative type**

98.17 % weighted coverage of the inventive principles (IP) included in Table IV. of Contradictions between Needs to Satisfy (NS), in relation to the IP included in Table II Specific Contradiction Matrix.
The inventive principles labeled with nT2 are not found in Table II. Due to this condition, the first three contradictions in Table IV containing principles marked with nT2 are described as a Solution among Needs to Satisfy in Table IX. This solution, combined with the previously mentioned Base Solution, forms the Recommended Solution by the Aatrizinventor Algorithm, shown in Table V.
From practical experience, if Table IV contains more than 3 contradictions with inventive principles not included in Table II, then it is likely to be more challenging to construct a specific solution. In that case, it is recommended to look for an alternative combination of parameters in Table VI of sensitivity analysis. It is also an option to select another need to satisfy, which is shown in Table VII Essential Contradictions of Needs to Satisfy (NS) for the same undesirable effects already evaluated for GROUNDED CARGO SHIP.
To evaluate the recommended inventive principles here and the corresponding contradictions in which they participate, it is necessary for the Base Solution to guide an initial context for the solution, as the contradictions between Needs to Satisfy do not identify which variable of the evaluated object S1 should be operated.
Inventive principles labeled with nT3 are included in Table II, but do not participate in the Recommended Solution shown in Table V. The Innovation Team must review the contradictions where they participate, to determine if there were other specific aspects that could be significant for the solution.
Unmarked inventive principles are included in Table II Specific Contradiction Matrix and in Table V Recommended Solution.

TABLE V. RECOMMENDED SOLUTION FOR INNOVATION CHALLENGE FOR EVALUATED OBJECT GROUNDED CARGO SHIP
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility
Evaluated need to satisfy in this report: **27. Reliability**
UDEs: (+) 1. Heaviness of moving object// (+) 3. Length of moving object// (+) 11. Pressure/ Tension// (+) 30. Object-affected harmful factors

Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4

(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	Essential	wt.1	**1 Es.**	**15 Es.**	**17 Es.**	**24 Es.**
(+) 3. Length of moving object	(+) 11. Pressure/ Tension	Compl. 1	wt.3	**1 Es.**	8	35	0
(+) 1. Heaviness of moving object	(+) 30. Object-affected harmful factors	Compl. 2	wt.8	22	21	18	27
(+) 27. Reliability	(+) 30. Object-affected harmful factors	Compl. 3	wt.9	27	35	2	40
(+) 11. Pressure/ Tension	(+) 30. Object-affected harmful factors	Compl. 4	wt.11	22	2	37	0
27. Reliability	39. Productivity	NS.1	wns.1	**1 Es.**	35	29	38
27. Reliability	15. Duration of action of moving object	NS.2	wns.2	2	35	3	25

Relevant inventive principles from Table II not included in Recommended Solution
Before deciding on the solution, make sure you have previously reviewed the contradictions with relevant Inventive Principles from Table II, not included in the Recommended Solution. The 3 most relevant are shown below.

IP.10. Preliminary Action (Pos.1) ***	IP. Str.	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.27][Par.1][IP(s) : 3,8,10,40] - [Par.11][Par.3][IP(s) : 35,10,36,0] - [Par.1][Par.11][IP(s) : 10,36,37,40] - [Par.27][Par.11][IP(s) : 10,24,35,19] - [Par.3][Par.27][IP(s) : 10,14,29,40] - [Par.11][Par.27][IP(s) : 10,13,19,35] -
IP.36. Phase, State or Condition Transitions (Pos.11) ***	**IP. Oper.**	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.11][Par.3][IP(s) : 35,10,36,0] - [Par.1][Par.11][IP(s) : 10,36,37,40] -
IP.14. Spheroidality - Curvature - Angle (Pos.14) ***	IP. Tac.	[Par.27][Par.3][IP(s) : 15,9,14,4] - [Par.3][Par.27][IP(s) : 10,14,29,40] -

Inventive Principles (IP) selected for Recommended Solution:

To develop a Specific Solution based on the contradictions provided in Table V, where S1: GROUNDED CARGO SHIP interacts with S2: SUEZ CANAL SEAFLOOR, the Innovation Team must analyze the recommended innovation concepts for each selected inventive principle listed below. At least one concept from each principle that is applicable to the challenge under evaluation should be chosen.
Once the concepts are selected per inventive principle, it is essential to conduct an 'integrated reading' of

the contradictions indicated in Table V. If this 'integrated reading' can demonstrate a coherent logical thread for each selected contradiction and as a whole, then it can be considered that there is a potential innovation solution.
To complete the definition of the specific solution, it is necessary to review the relevant inventive principles from Table II that were not included in the Recommended Solution in Table V, which are presented above.
For more details on the selected contradictions, you can review the complete descriptions of the inventive principles by contradiction, as shown in Table IX.
In the Starting Manual, Fundamentals of Aatrizinventor, Point 11, an example is provided for developing the Specific Solution based on the Recommended Solution by the Aatrizinventor algorithm, based on the 'Language of Nature Innovation.' The identification of a specific solution is a systematic and iterative process involving multiple concepts, aiming to determine a comprehensive solution with minimal implementation costs and maximum benefit-to-cost ratio.
It's important noting that an asterisk (*) has been added to the name of the object under evaluation to remind that the descriptions of the inventive principles may consider that GROUNDED CARGO SHIP can be in its current physical and functional state, or in a modified state, or even in a new state, as needed to achieve the desired objective. Please, make the most of your relational thinking skills.

Summary description of the Inventive Principles included in the Recommended Solution shown above, applicable to the challenge under evaluation for the defined space and time:

N°1 Improve: (+) 3. Length of moving object and Attenuate or Preserve: (+) 30. Object-affected harmful factors

IP.1. Segmenting/ Integrating - strategic type (1)

a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.
b. Integrate different existing or new parts, forms, phases, states or conditions of GROUNDED CARGO SHIP* in a single entity.
c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.
d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.

IP.15. Dynamics - strategic type (2)

a. Allow (or design) the characteristics of GROUNDED CARGO SHIP*, external environment, or process to change to an optimal, or to find an optimal, operating condition.
b. Divide GROUNDED CARGO SHIP* into parts that are capable of relative movement between each other.
c. If GROUNDED CARGO SHIP* (or process) is rigid or inflexible, make it flexible or adaptive.
d. To enhance the dynamics of GROUNDED CARGO SHIP* or the process, use feature(s) or object(s) available in the nearby environment.

IP.17. Another Dimension or Field - tactical type (3)

a. Add or remove physical dimensions or fields of action of GROUNDED CARGO SHIP*.
b. Move GROUNDED CARGO SHIP* to a new dimension in space or performance field.
c. Use for GROUNDED CARGO SHIP* multi-story arrangement of objects instead of a single-story arrangement.
d. Tilt or re-orient GROUNDED CARGO SHIP*; lay it on its side.
e. Use another side of a given dimension or field of GROUNDED CARGO SHIP*.

IP.24. Intermediary - tactical type (4)
a. for GROUNDED CARGO SHIP*, use an intermediary carrier article or intermediary process.
b. Merge GROUNDED CARGO SHIP* temporarily with another object (which can be easily removed or removed by itself).

N°2 Improve: (+) 3. Length of moving object and Attenuate or Preserve: (+) 11. Pressure/ Tension
IP.1. Segmenting/ Integrating - strategic type (5)
a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.
b. Integrate different existing or new parts, forms, phases, states or conditions of GROUNDED CARGO SHIP* in a single entity.
c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.
d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.
IP.8. Anti-Weight/ Compensation - tactical type (6)
a. To compensate for the heaviness/lightness or incidence of GROUNDED CARGO SHIP*, merge it with other objects or independent own parts that provide an effect to improve the current situation.
b. To compensate for the heaviness/lightness or incidence of GROUNDED CARGO SHIP*, make it interact with the environment.
IP.35. Transformation / Parameter Changes - strategic type (7)
a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).
b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.
c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

N°3 Improve: (+) 1. Heaviness of moving object and Attenuate or Preserve: (+) 30. Object-affected harmful factors
IP.22. Convert harm in benefit - strategic type (8)
a. Use harmful factors, or external effects related to harmful factors, for OBJECT S1 (particularly, effects of the environment or surroundings) to achieve a positive effect with GROUNDED CARGO SHIP*.
b. Eliminate a harmful primary action by adding another action to GROUNDED CARGO SHIP*, which counteracts the harmful action to solve the problem.
c. Amplify a harmful factor or a part of GROUNDED CARGO SHIP*, to such a degree that it is no longer harmful.
IP.21. Skipping/ Avoiding - tactical type (9)
a. Make sure that with GROUNDED CARGO SHIP*, the process, or certain stages (e.g., destructible, harmful, or hazardous operations), are conducted at high speed or during a minimum time of exposure to the risk.
b. Eventually, skip certain process stages GROUNDED CARGO SHIP*.
IP.18. Mechanical Vibrations/ Energy Variations - tactical type (10)
a. Move GROUNDED CARGO SHIP* by cycles with energies that activate it.
b. Cause GROUNDED CARGO SHIP* to oscillate or vibrate. Increase its frequency (even up to the ultrasonic). Use the resonant frequency of GROUNDED CARGO SHIP*. If necessary, decrease frequency.
c. Use vibration-generating fields in, or for, GROUNDED CARGO SHIP* instead of mechanical vibration generators. Combine sources of oscillations.

d. Apply alternation of GROUNDED CARGO SHIP* or its parts or functions.

IP.27. Cheap Short-Living Objects - strategic type (11)

a. Replace or divide (either fully or partially) GROUNDED CARGO SHIP* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.

b. Compress certain qualities of GROUNDED CARGO SHIP* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.

N°4 Improve: (+) 27. Reliability and Attenuate or Preserve: (+) 30. Object-affected harmful factors

IP.27. Cheap Short-Living Objects - strategic type (12)

a. Replace or divide (either fully or partially) GROUNDED CARGO SHIP* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.

b. Compress certain qualities of GROUNDED CARGO SHIP* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.

IP.35. Transformation / Parameter Changes - strategic type (13)

a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

IP.2. Taking out/ Adding - strategic type (14)

a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*. **b.** Add new parts or properties to GROUNDED CARGO SHIP*.

IP.40. Composite Materials/ Conditions - operative type (15)

a. Change from a uniform material, property, state, or condition in, or for, GROUNDED CARGO SHIP* , to a composite one, or vice versa.

N°5 Improve: (+) 11. Pressure/ Tension and Attenuate or Preserve: (+) 30. Object-affected harmful factors

IP.22. Convert harm in benefit - strategic type (16)

a. Use harmful factors, or external effects related to harmful factors, for OBJECT S1 (particularly, effects of the environment or surroundings) to achieve a positive effect with GROUNDED CARGO SHIP*.

b. Eliminate a harmful primary action by adding another action to GROUNDED CARGO SHIP*, which counteracts the harmful action to solve the problem.

c. Amplify a harmful factor or a part of GROUNDED CARGO SHIP*, to such a degree that it is no longer harmful.

IP.2. Taking out/ Adding - strategic type (17)

a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*. **b.** Add new parts or properties to GROUNDED CARGO SHIP*.

IP.37. Useful Perceptible Change - operative type (18)

a. Use state, dimension or condition changes occurring to GROUNDED CARGO SHIP*, because of a

modification or application of an external or self-generated field, which is perceptible by and can influence to object S2 with which it interacts. The change may be permanent or variable in time.

N°6 Improve: 27. Reliability and Preserve: 39. Productivity

IP.1. Segmenting/ Integrating - strategic type (19)

a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different existing or new parts, forms, phases, states or conditions of GROUNDED CARGO SHIP* in a single entity.

c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.

IP.35. Transformation / Parameter Changes - strategic type (20)

a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

IP.29. Controllable Soft Variables - tactical type (21)

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with GROUNDED CARGO SHIP* facilitating goal fulfillment of the function performed with Object S2.

b. Make easier GROUNDED CARGO SHIP* interact with Object S2 using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

IP.38. Strong or Quick Reactions - operative type (22)

a. Apply strong and/or quick reactions to GROUNDED CARGO SHIP* (e.g., apply strong oxidants, sudden change.).

N°7 Improve: 27. Reliability and Preserve: 15. Duration of action of moving object

IP.2. Taking out/ Adding - strategic type (23)

a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*. **b.** Add new parts or properties to GROUNDED CARGO SHIP*.

IP.35. Transformation / Parameter Changes - strategic type (24)

a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

IP.3. Local Quality - strategic type (25)

a. Improve quality in a localized way, for parts, components, or conditions of GROUNDED CARGO SHIP*.

b. Change the structure, action, or procedure of GROUNDED CARGO SHIP* from uniform to non-uniform, or vice versa.

c. Change the external environment (or external influence) of GROUNDED CARGO SHIP* from uniform to non-uniform, or vice versa.
d. Make each part of GROUNDED CARGO SHIP* function in the conditions that are most suitablx for its operation.
e. Make each part of GROUNDED CARGO SHIP* fulfill a different and useful function.
IP.25. Self-service - operative type (26)
a. Make GROUNDED CARGO SHIP* serve itself by performing helpful auxiliary functions.
b. Use resources, energy or substances that are wasted or unused by GROUNDED CARGO SHIP*. **c.** Incorporate resources and/or functions into GROUNDED CARGO SHIP* for self-service during operation.

N°8 Improve: and Preserve:

Relevant inventive principles from Table II not included in Recommended Solution
IP.10. Preliminary Action (Pos.(1) - strategic type (27)
a. Perform the required change in, or for, GROUNDED CARGO SHIP*, before it is needed (either fully or partially).
b. Pre-arrange GROUNDED CARGO SHIP* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.
IP.36. Phase, State or Condition Transitions (Pos.(11) - operative type (28)
a. Use the phenomena occurring during state, dimension, or condition transitions of OBJECT S1 to influence its interaction with object S2.
b. Use phenomena occurring during phase transitions associated with GROUNDED CARGO SHIP* (e.g., volume changes, loss, or absorption of heat, etc.) to influence its interaction with object S2.
IP.14. Spheroidality - Curvature - Angle (Pos.(14) - tactical type (29)
a. For the interaction between GROUNDED CARGO SHIP* and Object S2, instead of using rectilinear parts, surfaces, or shapes, use curvilinear, enveloping, or angled parts.
b. For the interaction between GROUNDED CARGO SHIP* and Object S2, instead of acting in a linear or direct way, interact in an indirect way or with curvilinear, surrounding, or angled movements.
c. Move GROUNDED CARGO SHIP* from flat to spherical surfaces; from parts shaped as a cube (parallelepiped) to ball-shaped structures. **d.** Use rolls, balls, spirals, domes in, or for, GROUNDED CARGO SHIP*.
e. Go from linear to rotary motion, use centrifugal forces in, or for, GROUNDED CARGO SHIP*.
f. If there is Spheroidality , curvature or angle, increase or reduce, as applicable, in, or for, GROUNDED CARGO SHIP*.

TABLE VI. RESULTS OF SENSITIVITY ANALYSIS FOR THE EVALUATED OBJECT GROUNDED CARGO SHIP
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

Coverage obtained for the current evaluation to compare with sensitivity analysis

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)

#	1	3	11	30	27. Reliability	98.17	100	98.62

Table VI presents the 10 most favorable parameter combinations recommended by the Aatrizinventor algorithm. It is suggested to evaluate the 2 or 3 most relevant ones. Practice teaches that they often contain the best solution for the evaluated challenge.

(E) Combination of TRIZ innovation parameters evaluated in this Aatrizinventor Solution is prioritized here

A. PRIORITISED CONTRADICTIONS BY GLOBAL COVERAGE (Cob.GL)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
I.a	1	3	11	30	27. Reliability **(E)**	98.17	100	98.62
II.a	1	5	9	30	27. Reliability	98.17	100	98.62
III.a	3	9	11	30	27. Reliability	97.72	100	98.29
IV.a	3	9	12	30	27. Reliability	97.25	100	97.94
V.a	5	9	11	30	27. Reliability	96.36	100	97.27

B. PRIORITIZATION OF CONTRADICTIONS BY COVERAGE OF NEEDS TO SATISFY (Cob.NS)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)	Table VI.A
I.b	1	5	11	30	27. Reliability	99.08	21.32	79.64	-
II.b	1	5	9	11	27. Reliability	99.08	9.91	76.79	-
III.b	1	3	11	30	27. Reliability **(E)**	98.17	100	98.62	I.a
IV.b	1	5	9	30	27. Reliability	98.17	100	98.62	II.a
V.b	1	3	9	30	27. Reliability	98.17	13.63	77.03	-

TABLE VII ESSENTIAL CONTRADICTIONS MATRIX FOR NEEDS TO SATISFY (NS) FOR THE SAME UNDESIRABLE EFFECTS EVALUATED OF: GROUNDED CARGO SHIP

CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

Evaluated need to satisfy in this report: **27. Reliability**

UDEs: (+) 1. Heaviness of moving object// (+) 3. Length of moving object// (+) 11. Pressure/ Tension// (+) 30. Object-affected harmful factors

This table allows the Innovation Team to compare the coverages obtained for the evaluated need to satisfy with those of the other defined needs, for the same undesirable effects. This way, they can decide whether to choose any of the suggested innovation parameter combinations here that offer better coverage.

Need to Satisfy	Parameter to improve	Parameter to attenuate or preserve	Contradict. Essential	Cob. NS (%)	Cob. between EC (%)	Cob. GL (%) 3/1
27. Reliability	(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	[1,15,17,24]	98.17	100	98.62
32. Ease of achieving desired outcome	(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	[1,15,17,24]	85.12	100	88.84
13. Stability	(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	[1,15,17,24]	83.09	100	87.31
33. Ease of operation	(+) 33. Ease of operation	(+) 1. Heaviness of moving object	[25,2,13,15]	93.1	33.82	78.28
35. Adaptability or versatility	(+) 35. Adaptability or versatility	(+) 3. Length of moving object	[35,1,29,2]	74.88	87.39	78.01
34. Ease of change, repair or maintain	(+) 30. Object-affected harmful factors	(+) 34. Ease of change, repair or maintain	[35,10,2,0]	86.04	49.55	76.91
38. Extent of automation/ autonomy	(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	[1,15,17,24]	68.57	100	76.43
19. Use of energy by moving object	(+) 3. Length of moving object	(+) 30. Object-affected harmful factors	[1,15,17,24]	63.47	100	72.6
39. Productivity	(+) 11. Pressure/ Tension	(+) 39. Productivity	[10,14,35,37]	85.63	25.53	70.6
15. Duration of action of moving object	(+) 15. Duration of action of moving object	(+) 1. Heaviness of moving object	[19,5,34,31]	66.58	9.89	52.41

Table VII shows the essential contradictions obtained for each of the defined Needs to Satisfy, taking into account the same undesirable effects that have been evaluated. This table is based on the calculation of a global coverage (Cob.GL), which is determined by combining two values: the coverage from Table IV (Cob.NS) already explained, and a relative coverage (Cob. between EC) that is obtained in this table VII,

when each other comparing the essential contradictions identified for the 10 parameters of Needs to Satisfy.
This global coverage (GL) is based on expert weighting criteria to prioritize the solutions for the different Needs to Satisfy. Experience with aatrizinventor indicates that the most effective solutions are those with higher global coverage, preferably exceeding 90%, if possible.
The Innovation Team may decide if it is appropriate to carry out a new evaluation with another Need to Satisfy, selected from the results provided in Table VII. This decision will be primarily made when the evaluated Need to Satisfy is not ranked in the first position of Table VII. In this table, the position of the evaluated Need to Satisfy is highlighted: 27. Reliability.

TABLE VIII. ORDER OF INCIDENCE OF INVENTIVE PRINCIPLES (POS.n)
CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility
Participation analysis of inventive principles in TABLE II SPECIFIC CONTRADICTION MATRIX.
Evaluated parameters for Object GROUNDED CARGO SHIP:
Par. UDEs:
(+) 1. Heaviness of moving object
(+) 3. Length of moving object
(+) 11. Pressure/ Tension
(+) 30. Object-affected harmful factors
Par. NS: (+) 27. Reliability

***: Inventive Principles from the Specific Contradiction Matrix (Table II) not described in the Recommend Solution (Table IX). It is recommended to perform an additional review following the order of position.

Inventive principles of Table II	IP type	Tables	Contradictions
IP.10. Preliminary Action (Pos.1) ***	IP. Str.	II /	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.27][Par.1][IP(s) : 3,8,10,40] - [Par.11][Par.3][IP(s) : 35,10,36,0] - [Par.1][Par.11][IP(s) : 10,36,37,40] - [Par.27][Par.11][IP(s) : 10,24,35,19] - [Par.3][Par.27][IP(s) : 10,14,29,40] - [Par.11][Par.27][IP(s) : 10,13,19,35] -
IP.22. Convert harm in benefit (Pos.2)	IP. Str.	II / III /	[Par.30][Par.1][IP(s) : 22,21,27,39] - [Par.30][Par.11][IP(s) : 22,2,37,0] - [Par.1][Par.30][IP(s) : 22,21,18,27] - [Par.11][Par.30][IP(s) : 22,2,37,0] -
IP.1. Segmenting/ Integrating (Pos.3)	IP. Str.	II / III / IV	[Par.30][Par.3][IP(s) : 17,1,39,4] - [Par.3][Par.11][IP(s) : 1,8,35,0] - [Par.3][Par.30][IP(s) : 1,15,17,24] - [Par.1][Par.27][IP(s) : 1,3,11,27] -
IP.15. Dynamics (Pos.4)	IP. Str.	II / III /	[Par.3][Par.1][IP(s) : 8,15,29,34] - [Par.1][Par.3][IP(s) : 15,8,29,34] - [Par.27][Par.3][IP(s) : 15,9,14,4] - [Par.3][Par.30][IP(s) : 1,15,17,24] -

IP.27. Cheap Short-Living Objects (Pos.5)	IP. Str.	II / III / IV	[Par.30][Par.1][IP(s) : 22,21,27,39] - [Par.1][Par.30][IP(s) : 22,21,18,27] - [Par.27][Par.30][IP(s) : 27,35,2,40] - [Par.1][Par.27][IP(s) : 1,3,11,27] - [Par.30][Par.27][IP(s) : 27,24,2,40] -
IP.8. Anti-Weight/ Compensation (Pos.6)	IP. Tac.	II / III / IV	[Par.3][Par.1][IP(s) : 8,15,29,34] - [Par.27][Par.1][IP(s) : 3,8,10,40] - [Par.1][Par.3][IP(s) : 15,8,29,34] - [Par.3][Par.11][IP(s) : 1,8,35,0] -
IP.35. Transformation / Parameter Changes (Pos.7)	IP. Str.	II / III / IV	[Par.11][Par.3][IP(s) : 35,10,36,0] - [Par.3][Par.11][IP(s) : 1,8,35,0] - [Par.27][Par.11][IP(s) : 10,24,35,19] - [Par.27][Par.30][IP(s) : 27,35,2,40] - [Par.11][Par.27][IP(s) : 10,13,19,35] -
IP.3. Local Quality (Pos.8)	IP. Str.	II / IV	[Par.27][Par.1][IP(s) : 3,8,10,40] - [Par.1][Par.27][IP(s) : 1,3,11,27] -
IP.17. Another Dimension or Field (Pos.9)	IP. Tac.	II / III / IV	[Par.30][Par.3][IP(s) : 17,1,39,4] - [Par.3][Par.30][IP(s) : 1,15,17,24] -
IP.2. Taking out/ Adding (Pos.10)	IP. Str.	II / III / IV	[Par.30][Par.11][IP(s) : 22,2,37,0] - [Par.11][Par.30][IP(s) : 22,2,37,0] - [Par.27][Par.30][IP(s) : 27,35,2,40] - [Par.30][Par.27][IP(s) : 27,24,2,40] -
IP.36. Phase, State or Condition Transitions (Pos.11) ***	**IP. Oper.**	II /	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.11][Par.3][IP(s) : 35,10,36,0] - [Par.1][Par.11][IP(s) : 10,36,37,40] -
IP.24. Intermediary (Pos.12)	IP. Tac.	II / III / IV	[Par.27][Par.11][IP(s) : 10,24,35,19] - [Par.3][Par.30][IP(s) : 1,15,17,24] - [Par.30][Par.27][IP(s) : 27,24,2,40] -
IP.21. Skipping/ Avoiding (Pos.13)	IP. Tac.	II / III / IV	[Par.30][Par.1][IP(s) : 22,21,27,39] - [Par.1][Par.30][IP(s) : 22,21,18,27] -
IP.14. Spheroidality - Curvature - Angle (Pos.14) ***	IP. Tac.	II /	[Par.27][Par.3][IP(s) : 15,9,14,4] - [Par.3][Par.27][IP(s) : 10,14,29,40] -
IP.37. Useful Perceptible Change (Pos.15)	**IP. Oper.**	II / III /	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.1][Par.11][IP(s) : 10,36,37,40] - [Par.30][Par.11][IP(s) : 22,2,37,0] - [Par.11][Par.30][IP(s) : 22,2,37,0] -
IP.13. Reverse or Indirect Action (Pos.16) ***	IP. Str.	II / IV	[Par.11][Par.27][IP(s) : 10,13,19,35] -
IP.9. Preliminary Anti-action (Pos.17) ***	**IP. Oper.**	II /	[Par.27][Par.3][IP(s) : 15,9,14,4] -

IP.29. Controllable Soft Variables (Pos.18)	IP. Tac.	II / IV	[Par.3][Par.1][IP(s) : 8,15,29,34] - [Par.1][Par.3][IP(s) : 15,8,29,34] - [Par.3][Par.27][IP(s) : 10,14,29,40] -
IP.40. Composite Materials/ Conditions (Pos.19)	**IP. Oper.**	II / III / IV	[Par.11][Par.1][IP(s) : 10,36,37,40] - [Par.27][Par.1][IP(s) : 3,8,10,40] - [Par.1][Par.11][IP(s) : 10,36,37,40] - [Par.27] [Par.30][IP(s) : 27,35,2,40] - [Par.3][Par.27][IP(s) : 10,14,29,40] - [Par.30][Par.27][IP(s) : 27,24,2,40] -
IP.39. Inert Atmosphere / Environment (Pos.20) ***	**IP. Oper.**	II /	[Par.30][Par.1][IP(s) : 22,21,27,39] - [Par.30][Par.3][IP(s) : 17,1,39,4] -
IP.19. Time-Varying Action/ Periodic or Pulsating (Pos.21) ***	IP. Str.	II / IV	[Par.27][Par.11][IP(s) : 10,24,35,19] - [Par.11][Par.27][IP(s) : 10,13,19,35] -
IP.18. Mechanical Vibrations/ Energy Variations (Pos.22)	IP. Tac.	II / III /	[Par.1][Par.30][IP(s) : 22,21,18,27] -
IP.11. Beforehand Cushioning (Pos.23) ***	IP. Tac.	II / IV	[Par.1][Par.27][IP(s) : 1,3,11,27] -
IP.34. Discarding and Recovering (Pos.24) ***	IP. Tac.	II /	[Par.3][Par.1][IP(s) : 8,15,29,34] - [Par.1][Par.3][IP(s) : 15,8,29,34] -
IP.4. Asymmetry/ Symmetry (Pos.25) ***	**IP. Oper.**	II /	[Par.30][Par.3][IP(s) : 17,1,39,4] - [Par.27][Par.3][IP(s) : 15,9,14,4] -

TABLE IX. RECOMMENDED SOLUTION ACCORDING TO THE MOST RELEVANT CONTRADICTIONS IDENTIFIED FOR THE EVALUATED OBJECT: GROUNDED CARGO SHIP

CHALLENGE: Improve Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility

This table displays the relevant contradictions identified by the algorithm, which are crucial for determining the direction and scope of the solution to the innovation challenge under evaluation. The specific solution will be obtained by applying the updated inventive principles detailed below.

It is essential to bear in mind that we are evaluating GROUNDED CARGO SHIP when it interacts with SUEZ CANAL SEAFLOOR and there is an affected function: Degrounding of a cargo ship stranded in the Suez Canal affected by running aground on the bottom of the canal due to low tide and lack of visibility, in a specific space and time. GROUNDED CARGO SHIP may require changes in space, time, its physical composition, or its functional characteristic, as well as partial or total replacement with another object or other recommended changes. To emphasize this concept, we mark GROUNDED CARGO SHIP with an asterisk. Do not read the name of the evaluated object literally; associate it with a possible solution for GROUNDED CARGO SHIP*.

Each inventive principle described here may contain more than one innovation concept recommended by TRIZ, identified as a, b, c, ..., not all of which are applicable to a specific case under evaluation. The Innovation Team must select those innovation concepts that best relate to the evaluated innovation challenge, based on their own knowledge and the analysis of relational thinking that they must carry out.

Additionally, technological research may be necessary for its solution, as the specific solution recommended by the inventive principles described here likely already exists somewhere in the world. The interpretation of the inventive principles, to apply them specifically to the evaluated case, is a recursive process that generally ranges from strategic to tactical and operational levels. We recommend completing the reading of the inventive principles described below to envision a possible solution and then rereading the principles to reinforce the coherence of the emerging solution. As a result of the finally determined innovation solution, there will be a change in GROUNDED CARGO SHIP, in a new context guided by the inventive principles, probably not previously imagined.

The Language of Nature's Innovation provides speed and focus for guided and systematic innovation thinking for individuals. The foundation for innovation is a profound understanding of the current situation.

IX.A BASE SOLUTION FOR INNOVATION CHALLENGE FOR THE EVALUATED OBJECT GROUNDED CARGO SHIP NEED TO SATISFY: 27. Reliability
Strategic inventive principles: Str. IP
Tactical inventive principles: Tac. IP
Operative inventive principles: Oper. IP
Pos.n : Order of importance n of an inventive principle included in Table II.

ESSENTIAL CONTRADICTION
Contradiction order wt.1

Parameter to improve: (+) 3. Length of moving object
TO IMPROVE (UDE): GROUNDED CARGO SHIP has More Own length or relative distance, whether physical or figurative interacting with S2
Parameter to attenuate or preserve: (+) 30. Object-affected harmful factors
TO ATTENUATE OR PRESERVE (UDE): GROUNDED CARGO SHIP has More Harmful factors affecting it by interacting with S2
Inventive principles IP(s) : [1,15,17,24]
1. Segmenting/ Integrating, Str. IP (Pos.3):
a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.
b. Integrate different parts, shapes, phases, states, or existing or new conditions of a GROUNDED CARGO SHIP* into a single entity..
c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.
d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation in space / Separation in subsystem
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance;

Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

15. Dynamics, Str. IP (Pos.4):

a. Allow (or design) the characteristics of GROUNDED CARGO SHIP*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide GROUNDED CARGO SHIP* into parts that are capable of relative movement between each other.

c. If GROUNDED CARGO SHIP* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of GROUNDED CARGO SHIP* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for GROUNDED CARGO SHIP* : Separation in time

Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

17. Another Dimension or Field, Tac. IP (Pos.9):

a. Add or remove physical dimensions or fields of action of GROUNDED CARGO SHIP*.

b. Move GROUNDED CARGO SHIP* to a new dimension in space or performance field.

c. Use for GROUNDED CARGO SHIP* multi-story arrangement of objects instead of a single-story arrangement.

d. Tilt or re-orient GROUNDED CARGO SHIP*; lay it on its side.

e. Use another side of a given dimension or field of GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation in space

Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

24. Intermediary, Tac. IP (Pos.12):

a. for GROUNDED CARGO SHIP*, use an intermediary carrier article or intermediary process.

b. Merge GROUNDED CARGO SHIP* temporarily with another object (which can be easily removed or removed by itself).

Separation principle for GROUNDED CARGO SHIP* : Separation in space

Solution strategy for GROUNDED CARGO SHIP* : Improving if a solution has not yet emerged

COMPLEMENTARY CONTRADICTION 1

Contradiction order wt.3

Parameter to improve: (+) 3. Length of moving object

TO IMPROVE (UDE): GROUNDED CARGO SHIP has More Own length or relative distance, whether physical or figurative interacting with S2

Parameter to attenuate or preserve: (+) 11. Pressure/ Tension

TO ATTENUATE OR PRESERVE (UDE): GROUNDED CARGO SHIP has More Pressure or tension interacting with S2

Inventive principles IP(s) : [1,8,35,0]

1. Segmenting/ Integrating, Str. IP (Pos.3):

a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different parts, shapes, phases, states, or existing or new conditions of a GROUNDED CARGO SHIP* into a single entity..
c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.
d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation in space / Separation in subsystem
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged
8. Anti-weight/ Compensation, Tac. IP (Pos.6):
a. To compensate for the heaviness/lightness or incidence of GROUNDED CARGO SHIP*, merge it with other objects or independent own parts that provide an effect to improve the current situation.
b. To compensate for the heaviness/lightness or incidence of GROUNDED CARGO SHIP*, make it interact with the environment.
For example, compensate for the heaviness of GROUNDED CARGO SHIP* subject to a gravitational field, or exposed to a magnetic field, or subject to an economic value or price, or subject to a chemical bond, or subject to intellectual rigidity, a paradigm, or prejudices.
Separation principle for GROUNDED CARGO SHIP* : Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes
35. Transformation/ Parameter Changes, Str. IP (Pos.7):
a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).
b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.
c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation by condition / Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

COMPLEMENTARY CONTRADICTION 2
Contradiction order wt.8

Parameter to improve: (+) 1. Heaviness of moving object
TO IMPROVE (UDE): GROUNDED CARGO SHIP has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
Parameter to attenuate or preserve: (+) 30. Object-affected harmful factors
TO ATTENUATE OR PRESERVE (UDE): GROUNDED CARGO SHIP has More Harmful factors affecting it by interacting with S2
Inventive principles IP(s) : [22,21,18,27]
22. Blessing in Disguise, Str. IP (Pos.2):
a. Use harmful factors, or external effects related to harmful factors, for GROUNDED CARGO SHIP* (particularly, effects of the environment or surroundings) to achieve a positive effect with GROUNDED CARGO SHIP*.
b. Eliminate a harmful primary action by adding another action to GROUNDED CARGO SHIP*, which counteracts the harmful action to solve the problem.

c. Amplify a harmful factor or a part of GROUNDED CARGO SHIP*, to such a degree that it is no longer harmful.
Separation principle for GROUNDED CARGO SHIP* : Integration in supersystem
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged
21. Skipping/ Avoiding, Tac. IP (Pos.13):
a. Make sure that with GROUNDED CARGO SHIP*, the process, or certain stages (e.g., destructible, harmful, or hazardous operations), are conducted at high speed or during a minimum time of exposure to the risk.
b. Eventually, skip certain process stages GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation in time
Solution strategy for GROUNDED CARGO SHIP* : Improving performance
18. Mechanical Vibrations/ Energy Variations, Tac. IP (Pos.22):
a. Move GROUNDED CARGO SHIP* by cycles with energies that activate it
b. Cause GROUNDED CARGO SHIP* to oscillate or vibrate. Increase its frequency (even up to the ultrasonic). Use the resonant frequency of GROUNDED CARGO SHIP*. If necessary, decrease frequency.
c. Use vibration-generating fields in, or for, GROUNDED CARGO SHIP* instead of mechanical vibration generators. Combine sources of oscillations (e.g., ultrasonic, and electromagnetic).
d. Apply alternation of GROUNDED CARGO SHIP* or its functions.
Separation principle for GROUNDED CARGO SHIP* : Separation in time
Solution strategy for GROUNDED CARGO SHIP* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)
27. Cheap Short-Living Objects, Str. IP (Pos.5):
a. Replace or divide (either fully or partially) GROUNDED CARGO SHIP* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
b. Comprising certain qualities of GROUNDED CARGO SHIP* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.
Separation principle for GROUNDED CARGO SHIP* : Separation in subsystem
Solution strategy for GROUNDED CARGO SHIP* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

COMPLEMENTARY CONTRADICTION 3
Contradiction order wt.9

Parameter to improve: (+) 27. Reliability
TO IMPROVE (DE): GROUNDED CARGO SHIP has More Desired reliability to interact with S2
Parameter to attenuate or preserve: (+) 30. Object-affected harmful factors
TO ATTENUATE OR PRESERVE (UDE): GROUNDED CARGO SHIP has More Harmful factors affecting it by interacting with S2
Inventive principles IP(s) : [27,35,2,40]
27. Cheap Short-Living Objects, Str. IP (Pos.5):
a. Replace or divide (either fully or partially) GROUNDED CARGO SHIP* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics

and properties, and/or are limited but sufficient to achieve the desired objective.
b. Comprising certain qualities of GROUNDED CARGO SHIP* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.
Separation principle for GROUNDED CARGO SHIP* : Separation in subsystem
Solution strategy for GROUNDED CARGO SHIP* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)
35. Transformation/ Parameter Changes, Str. IP (Pos.7):
a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).
b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.
c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation by condition / Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)
2. Taking Out/ Adding, Str. IP (Pos.10):
a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*.
b. Add new parts or properties to GROUNDED CARGO SHIP*.
Separation principle for GROUNDED CARGO SHIP* : Separation in space
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes
40. Composite Materials/ Conditions, Oper. IP (Pos.19):
a. Change from a uniform material, property, state, or condition in, or for, GROUNDED CARGO SHIP* , to a composite one, or vice versa.
Separation principle for GROUNDED CARGO SHIP* : Separation by condition
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes

COMPLEMENTARY CONTRADICTION 4
Contradiction order wt.11

Parameter to improve: (+) 11. Pressure/ Tension
TO IMPROVE (UDE): GROUNDED CARGO SHIP has More Pressure or tension interacting with S2
Parameter to attenuate or preserve: (+) 30. Object-affected harmful factors
TO ATTENUATE OR PRESERVE (UDE): GROUNDED CARGO SHIP has More Harmful factors affecting it by interacting with S2
Inventive principles IP(s) : [22,2,37,0]
22. Blessing in Disguise, Str. IP (Pos.2):
a. Use harmful factors, or external effects related to harmful factors, for GROUNDED CARGO SHIP* (particularly, effects of the environment or surroundings) to achieve a positive effect with GROUNDED CARGO SHIP*.
b. Eliminate a harmful primary action by adding another action to GROUNDED CARGO SHIP*, which counteracts the harmful action to solve the problem.
c. Amplify a harmful factor or a part of GROUNDED CARGO SHIP*, to such a degree that it is no longer harmful.

Separation principle for GROUNDED CARGO SHIP* : Integration in supersystem
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

2. Taking Out/ Adding, Str. IP (Pos.10):

a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*.

b. Add new parts or properties to GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation in space
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes

37. Useful Perceptible Change , Oper. IP (Pos.15):

a. Use state, dimension or condition changes occurring to GROUNDED CARGO SHIP*, because of a modification or application of an external or self-generated field, which is perceptible by and can influence to object (S2) with which it interacts.
The change may be permanent or variable in time.
(e.g., use field emissions, thermal expansion (or contraction) of materials, signals, etc.).

Separation principle for GROUNDED CARGO SHIP* : Separation in time
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes

IX.B SOLUTION TO MORE RELEVANT CONTRADICTIONS BETWEEN NEEDS TO SATISFY (Cob.NS)

Included in each inventive principle described below is the incidence level or position number it occupies in Table II. If it is not shown, it means that it only appears in Table IV. and requires attention.

CONTRADICTION BETWEEN NEEDS TO SATISFY N° 1

Parameter to improve 27. Reliability

MEJORAR > GROUNDED CARGO SHIP tiene More Desired reliability to interact with S2

Parameter to preserve 39. Productivity

PRESERVAR > GROUNDED CARGO SHIP tiene más efecto deseable por párametro 39. Productivity

Inventive principles IP(s) : [1,35,29,38]

1. Segmenting/ Integrating, Str. IP (Pos.3):

a. Divide GROUNDED CARGO SHIP* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different parts, shapes, phases, states, or existing or new conditions of a GROUNDED CARGO SHIP* into a single entity..

c. Make GROUNDED CARGO SHIP* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation in space / Separation in subsystem
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

35. Transformation/ Parameter Changes, Str. IP (Pos.7):

a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation by condition / Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

29. Controllable Soft Variables, Tac. IP (Pos.18):

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with GROUNDED CARGO SHIP* facilitating goal fulfillment of the function performed with S2 Object.

b. Make easier GROUNDED CARGO SHIP* interact with S2 Object using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

Separation principle for GROUNDED CARGO SHIP* : Separation in time
Solution strategy for GROUNDED CARGO SHIP* : Improving if a solution has not yet emerged

38. Strong or Fast Reactions, Oper. IP (Pos.):

a. Apply strong and/or quick reactions to GROUNDED CARGO SHIP* (e.g., apply strong oxidants, sudden change.).

Separation principle for GROUNDED CARGO SHIP* : Separation by condition
Solution strategy for GROUNDED CARGO SHIP* : Improving if a solution has not yet emerged

CONTRADICTION BETWEEN NEEDS TO SATISFY N° 2

Parameter to improve 27. Reliability

MEJORAR > GROUNDED CARGO SHIP tiene More Desired reliability to interact with S2

Parameter to preserve 15. Duration of action of moving object

PRESERVAR > GROUNDED CARGO SHIP tiene más efecto deseable por párametro 15. Duration of action of moving object

Inventive principles IP(s) : [2,35,3,25]

2. Taking Out/ Adding, Str. IP (Pos.10):

a. Separate an interfering part or a property from GROUNDED CARGO SHIP*, or single out the only necessary part (or property) of GROUNDED CARGO SHIP*.

b. Add new parts or properties to GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation in space
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes

35. Transformation/ Parameter Changes, Str. IP (Pos.7):

a. Change GROUNDED CARGO SHIP*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of GROUNDED CARGO SHIP* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of GROUNDED CARGO SHIP*.

Separation principle for GROUNDED CARGO SHIP* : Separation by condition / Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

3. Local quality, Str. IP (Pos.8):

a. Improve quality in a localized way, for parts, components, or conditions of GROUNDED CARGO SHIP*.

b. Change the structure, action, or procedure of GROUNDED CARGO SHIP* from uniform to non-uniform, or vice versa.
c. Change the external environment (or external influence) of GROUNDED CARGO SHIP* from uniform to non-uniform, or vice versa.
d. Make each part of GROUNDED CARGO SHIP* function in the conditions that are most suitablx for its operation.
e. Make each part of GROUNDED CARGO SHIP* fulfill a different and useful function.
Separation principle for GROUNDED CARGO SHIP* : Separation in space
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

25. Self-service, Oper. IP (Pos.):
a. Make GROUNDED CARGO SHIP* serve itself by performing helpful auxiliary functions.
b. Use resources, energy or substances that are wasted or unused by GROUNDED CARGO SHIP*.
c. Incorporate resources and/or functions into GROUNDED CARGO SHIP* for self-service during operation.
Separation principle for GROUNDED CARGO SHIP* : Separation in subsystem / Separation alternative
Solution strategy for GROUNDED CARGO SHIP* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

Anexo
List of applicable Inventive Principles for Innovation Solutions

IP.1. Segmenting/ Integrating	IP.21. Skipping/ Avoiding
IP.2. Taking out/ Adding	IP.22. Convert harm in benefit
IP.3. Local Quality	IP.23. Feedback
IP.4. Asymmetry/ Symmetry	IP.24. Intermediary
IP.5. Merging/ Separating	IP.25. Self-service
IP.6. Universality	IP.26. Copying/ Replicating
IP.7. Nesting/ Dispersing	IP.27. Cheap Short-Living Objects
IP.8. Anti-Weight/ Compensation	IP.28. Mechanics Substitution
IP.9. Preliminary Anti-action	IP.29. Controllable Soft Variables
IP.10. Preliminary Action	IP.30. Simple Shapes/ Ways to Interact
IP.11. Beforehand Cushioning	IP.31. 31.Using/ Removing Unused Parts
IP.12. Equipotentiality	IP.32. Perception/ Appearance/ Color Changes
IP.13. Reverse or Indirect Action	IP.33. Homogeneity / Compatibility
IP.14. Spheroidality - Curvature - Angle	IP.34. Discarding and Recovering
IP.15. Dynamics	P.35. Transformation / Parameter Changes

IP.16. Partial or Excessive Actions	IP.36. Phase, State or Condition Transitions
IP.17. Another Dimension or Field	IP.37. Useful Perceptible Change
IP.18. Mechanical Vibrations/ Energy Variations	IP.38. Strong or Quick Reactions
IP.19. Time-Varying Action/ Periodic or Pulsating	IP.39. Inert Atmosphere / Environment
IP.20. Continuity of Useful Action	IP.40. Composite Materials/ Conditions

Available Aatrizinventor solutions: 0 - You can get more solutions in home page link.

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