оперативные изменения в развитие системы управления промышленной безопасностью, что, безусловно, должно положительно сказаться на обеспечении безопасной эксплуатации опасных производственных объектов.

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**Plotnikov N.I.**

## Investigation of aviation accidents. Part 1. On the logical study of causality of sequence and cause

**Abstract**: A new approach to investigation of aviation accidents is proposed, based logical research. The ICAO standard sets out the subject matter content and key definitions of Investigation of aviation accidents. Starting with the glossary of modern standards, the unsatisfactory logical development of the documents becomes noticeable. Aviation accident investigation, cannot be considered sufficiently scientifically substantiated.

**Keywords**: standards, aviation accidents, aviation incident, investigation, investigator-in-charge

### Introduction

This paper examines the subject of civil aviation accident (AA) investigation in the context of international ICAO standards. Key definitions and the structure of the investigation task are presented. Logical analysis of the relationship between the basis and the consequence

in the progressive direction and in the regressive direction can give different consequences in different cases, and as for the consequence, the same consequence can be obtained from different reasons. Modeling of the cause-and-consequence relationship of events is possible with a description in non-classical logic, also called qualitative, pseudo-quantitative, pseudophysical logic (PL). This paper offers descriptions of the logic of relations, temporal, spatial, causal logic, their combination on a subjective heuristic basis for the presentation of knowledge. The conclusion contains the need for a detailed logical study of modern standards and guidelines.

**Key definitions**

The ICAO standard sets out the following subject matter content and key definitions Investigation of aviation accidents [1].

*Accident*. An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of:

– being in the aircraft, or

– direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or

– direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:

– adversely affects the structural strength, performance or flight characteristics of the aircraft, and

– would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades,

tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible.

*Incident*. An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

*Investigation*. A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and/or contributing factors and, when appropriate, the making of safety recommendations.

*Investigator-in-charge*. A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.

The above content does not reveal any logical constructions of investigations.

**Theory of multiple causes and consequence in logic**

The Russian philosopher and logician N.O. Lossky considered the theory of multiple causes unproven: "Language does not at all serve as a uniform and precise expression of thought. In logic, we refuse to divide judgments by modality, recognizing all judgments as equally possessing the character of necessity" [2].

"It is necessary to explain the unequal connection of the elements of judgment in the progressive and regressive directions. The first answer that comes to mind and is given by classical logic in a similar case, namely in the theory of conditional-categorical inferences (in explaining the impossibility of inferences from the presence of a consequence to the presence of a reason and from the absence of a reason to the absence of a consequence), is as follows: it can be assumed that the connection between reason and consequence is unambiguous in the progressive direction and polysemantic in the regressive direction; in other words, the reason leads to one specific system of consequences and cannot yield different consequences in different cases, while as for the consequence, the same consequence can be obtained from different reasons. Thus, flammability is a consequence of such different reasons as the chemical structure of wood, or the structure of alcohol, or the structure of fats, etc. Let us call

such an abundance of reasons for one and the same consequence a plurality of reasons."

Further, N. O. Lossky writes: "I consider this teaching to be erroneous and I believe that it leads to hopeless difficulties, if not in logic, then in the methodology of sciences. The connection between the basis and the consequence, in my opinion, is unambiguous not only in the progressive, but also in the regressive direction. Judgment, as is known, contains the connection between the basis and the consequence, but in no way can one assert that it consists only of the basis and the consequence: the first link of judgment is the cognized object; it contains the basis (the subject of judgment) for the predicate-consequence, but in addition to this, it usually has many more properties that are not important for the substantiation of the predicate. "From this it is clear that the connection of the elements of a judgment must be unambiguous in the progressive direction, and polysemantic in the regressive direction, even if it turns out, as we shall prove below, that the connection of the basis and the consequence is unambiguous in both directions: in fact, the object, containing the basis, serves as an infallible indicator of the presence of the predicate-consequence, but conversely the predicate cannot be an indicator of which object justified it, because the object also contains elements that are indifferent to the predicate; these elements are added to the core of the object that justifies the predicate in different cases in different ways, and therefore many very diverse objects can have the same predicate. Thus, we explain the polysemantic nature of the connection of the elements of a judgment in the regressive direction not by the multiplicity of bases for the same consequence, but by the multiplicity of objects for the same predicate" [2].

According to the author of this work, N. O. Lossky reveals the pseudo-logical nature of connections in situations where "trees and chains" of events cannot be described using statements of classical logic. "A series of individually defined events in nature is unambiguous not only progressively, but also regressively" [2]. "There really is no plurality of causes; any action can always be produced by only one cause. The connection between cause and effect is unambiguous in both directions" [2]. If an event is considered in its entire concrete completeness, then its cause is "only one specific, absolutely individual complex of events" [2].

**Pseudophysical logic of the causality relationship**

In eventology, an expedient activity (EA) includes the concepts of an event, an outcome, and uncertainty. EA studies transitions from the present state (PS), which is called (subjective) reality or (universal) reality, to the desired state (DS), which is called a possibility or a goal. Possibilities are vague compared to DS, realized in outcomes. The measure of the difference μ between DS and DS is called the result of activity R=μ{PS-DS}.

The key concept of eventology is an *event*, which can be understood as "co-event", "co-joint being", "co-simultaneous being"; the relationship of private reason and being; conscious, perceived, created by the private mind of a set of outcomes of being: occurs as a phenomenon, fact, state, situation, circumstances; in space, an event is localized by magnitude; in time - past, present and future, it occurs according to the frequency of manifestation. Reality - "action, deed is." Interaction: category of relationship; mutual penetration of events; mutual influence of elements of a set. Sets of causes and consequences form their aggregates.

Aggregates of causes and consequences have the property of transitivity. The logical conclusion of a cause-and-consequence relationship from cause to consequence is based on the property of transitivity and can be acceptably described by means of classical logic. The logical conclusion from consequences to causes is fuzzy [3]. A typical pseudo-cause is the statement "after this, therefore as a result of this." Logical conclusion of a cause-and-consequence relationship.

**Conclusion**

The pseudological nature of events turns out to be hidden and inaccessible in modern standards. Thus, modern technical standards and guidelines do not have the proper and necessary humanitarian elaboration - philosophical, philological, logical. As a result, R&D in regulation and management, using the example of the AA investigation, cannot be considered sufficiently scientifically substantiated.

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**Plotnikov N.I.**

## Investigation of aviation accidents. Part 2. Pseudophysical logic of event modeling

**Abstract**. A new approach to investigation of aviation accidents is proposed, based on logical research. The ICAO standard sets out the subject matter content and key definitions of Investigation of aviation accidents. Starting with the glossary of modern standards, the unsatisfactory logical development of the documents becomes noticeable. Aviation accident investigation, cannot be considered sufficiently scientifically substantiated.

**Keywords**: standards, aviation accidents, aviation incident, investigation, pseudophysical logic, natural language

**Introduction.** This paper examines the subject of civil aviation accident (AA) investigation in the context of international ICAO standards. Key definitions and the structure of the investigation task are presented. Logical analysis of the relationship between the basis and the consequence in the progressive direction and in the regressive direction can give different consequences in different cases, and as for the consequence, the same consequence can be obtained from different reasons. The conclusion contains the need for a detailed logical study of modern standards and guidelines.

Modeling of the cause-and-consequence relationship of events is possible with a description in non-classical logic, also called qualitative, pseudo-quantitative, pseudophysical logic (PL). This paper offers descriptions of the logic of relations, temporal, spatial, causal logic, their combination on a subjective heuristic basis for the presentation of knowledge. A classification of relations based on the categories "to have - to be" is compiled. The object is presented in the form of a relatively simple model that correlates with its actual complex description.

**Pseudophysical logic of relations**. The theory of PL models statements and reasoning of subjective meaning in terms of relations of