National Technical University of Ukraine
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Interactive Laboratory for Diagnosing Operational Materials in Energy and Transport
Scientific and Technical Union of Chemmotologists
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INTERNATIONAL EXPERIENCE AND THE CURRENT STATE OF SAF USE IN UKRAINE

PROFESSOR

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International experience and the current state of SAF use in Ukraine

Introduction – General Information

2050 ICAO VISION - the Second ICAO Conference on Aviation and Alternative Fuels (CAAF/2) was held in October 2017 in Mexico City, Mexico. It endorsed the 2050 ICAO Vision for Sustainable Aviation Fuels, which calls on States, industry and other stakeholders for a significant proportion of sustainable aviation fuel (SAF) use by 2050. The 2050 ICAO Vision will be updated at the CAAF/3, to be held in Dubai, United Arab Emirates as an in-person event from 21 to 24 November 2023.

Sustainable Aviation Fuel produced from sustainable feedstocks and is very similar in its chemistry to traditional fossil jet fuel. Using SAF results in a reduction in carbon emissions compared to the traditional jet fuel it replaces over the lifecycle of the fuel. Some typical feedstocks used are cooking oil and other non-palm waste oils from animals or plants; solid waste from homes and businesses, such as packaging, paper, textiles, and food scraps that would otherwise go to landfill or incineration. Other potential sources include forestry waste, such as waste wood, and energy crops, including fast growing plants and algae.

The 41st ICAO Assembly **adopted a long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050** in support of the UNFCCC Paris Agreement's temperature goal. This historic agreement reinforces the **leadership of ICAO** on issues relating to international aviation and climate change.

The LTAG report shows that SAF has the greatest potential to reduce CO_2 emissions from International Aviation.

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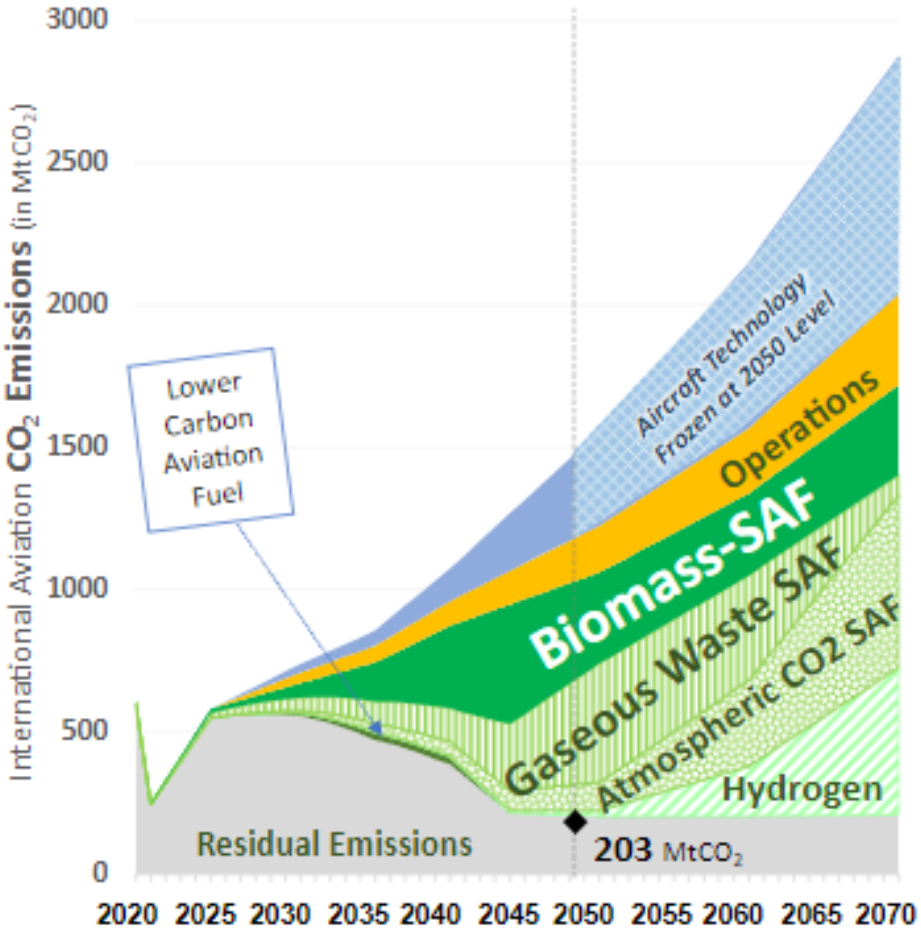
In February 2022, aviation and petroleum industry leaders and the US Federal Aviation Administration (FAA) announced a new initiative to phase out the use of leaded (TEL-containing) aviation gasoline by the end of 2030 without adversely affecting the existing piston engine fleet . The initiative is called Eliminate Aviation Gasoline Lead Emissions (EAGLE) and involves fuel manufacturers and distributors, airport operators, aircraft operators, the general aviation airport support community, military aviation and environmental experts.



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Our Chemmotological Team

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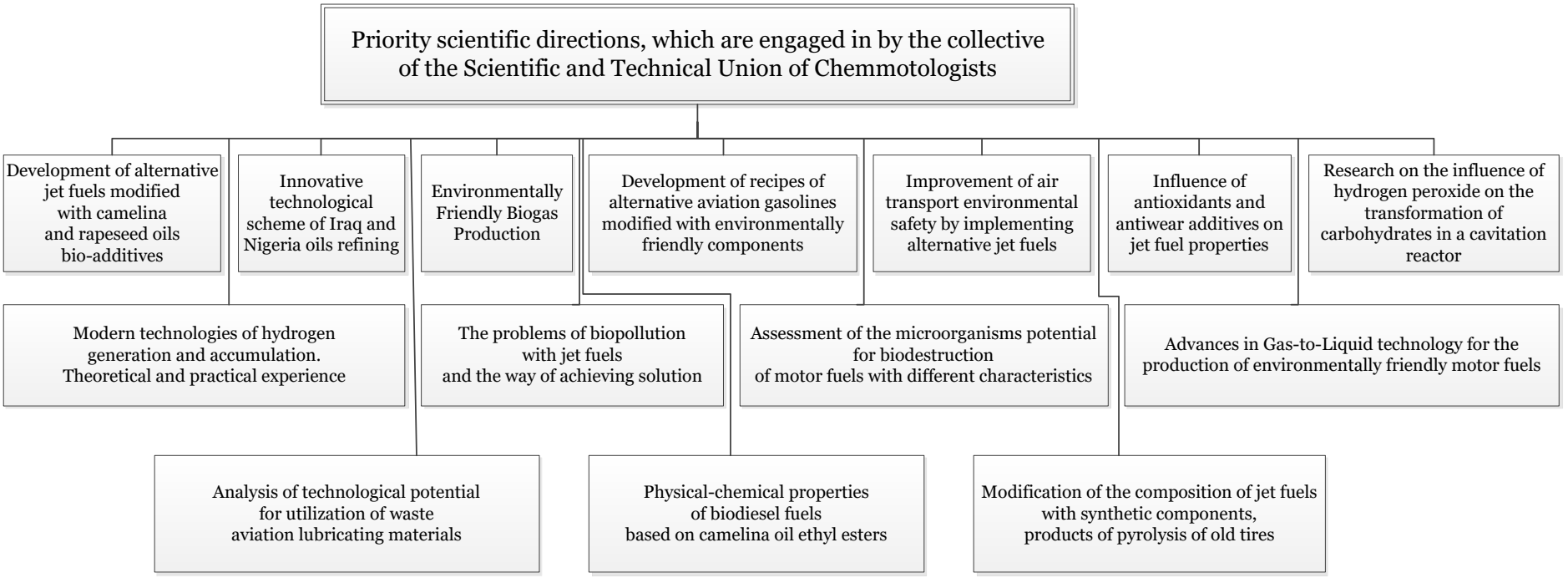
In Ukraine, the **Scientific and Technical Union of Chemmotologists** deals with these global problems. Priority scientific directions, which are engaged in by the collective of the union.



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By today in the World:

European Parliament resolution on mitigating the effects of aviation on climate change (INI / 2005/2249) states: «The European Parliament calls for the promotion of aviation biofuels in order to help minimize the effects of climate change».

At the same time, the European Commission approved a policy to reduce CO_2 levels by 60% by 2050, and the share of low carbon fuels in aviation should reach 40% by 2050.

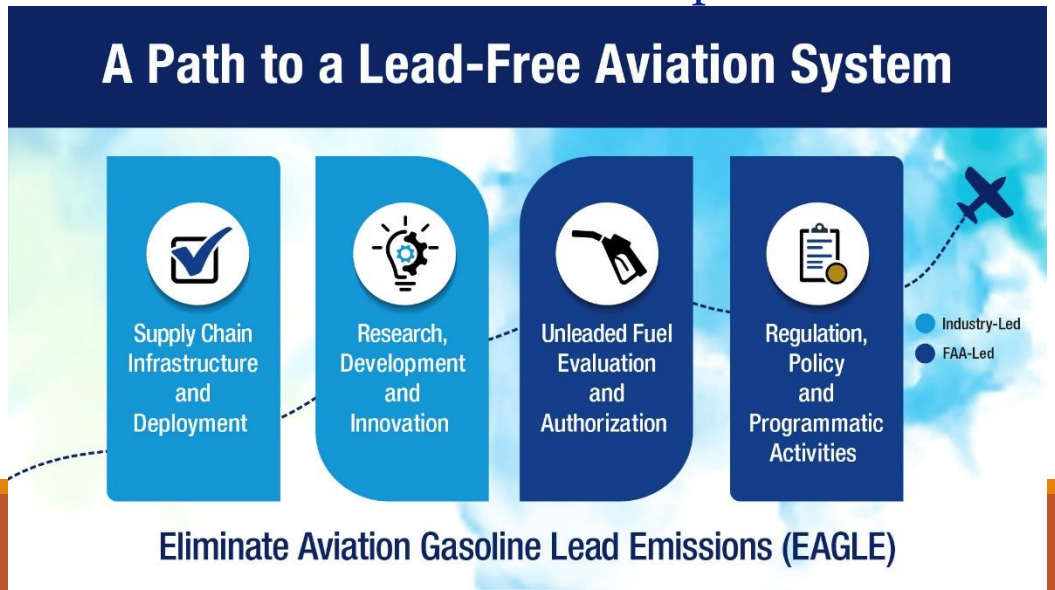
In its turn IATA sets for us a target to reduce CO_2 emissions from air transport by 50% by 2050.

- The updated standard for aviation fuel **Def Stan 91-91** «Turbine fuel, Kerosene type, Jet A-1», was put into operation, allowing the use of synthetic components in fuel;
- The updated standard **ASTM D1655** «Standard Specification for Aviation Turbine Fuels», was put into operation, providing the use of synthetic components;
- The new standard **ASTM D 7566** «Standard Specification for Aviation Fuel Containing Synthesized Hydrocarbons», was put into operation, setting the requirements to the quality of synthetic aviation fuels derived from non-oil raw materials.
- **ASTM D 6227** «Standard Specification for Unleaded Aviation Gasoline» was put into opeartion, for aviation gasoline of the 82UL и 87UL **and** UL 91 grade (**ASTM D7547**), 94UL (**ASTM D7592**), 102 UL (**ASTM D7719, ASTM D7960**), which envisages absence of TEL and presence of synthetic components.

The FAA and partners in the aviation community launched the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative to eliminate leaded aviation fuels in piston-engine aircraft safely by the end of 2030.

To achieve the lead-free goal, EAGLE will:

- Identify at least one unleaded fuel acceptable for safe General Aviation fleet use.
- Minimize the safety and technical impacts associated with high-performance engines using unleaded fuels.
- Facilitate the increased production, distribution and greater use of unleaded replacement fuels.
- Ensure that 100 low-lead fuel is available during the transition to unleaded fuel.
- Establish policies that support airport infrastructure funding for unleaded fuel.
- Endorse plans that reduce or eliminate reliance upon leaded aviation fuels.



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By today in Ukraine:

A number of important steps have been taken in Ukraine with the purpose of the active introduction and use of SAF in Ukraine. In particular:

- The chemmotological scientific school h*as developed* ***the Concept*** *of the development and introduction of environmentally safe jet fuel*;
- The chemmotological scientific school *has developed a draft* ***Technical Regulation*** *for the requirements for the quality of aviation gasoline and fuel for air jet engines;*
- The chemmotological scientific school is carrying out *a complex of* ***research works*** *on the development of new commercial formulas of alternative aviation fuels (BioJet), as well as the methodology for their introduction and use in civil aviation.*
- The chemmotological scientific school together with company *«Fuel and Alternative Technologies»* developed the standard *«Motor Fuel for Aviation Piston Engines».*
- The chemmotological scientific school *has developed national standard «Motor fuel for aviation engines. Technical requirements».*

SNW analysis of the SAF industry of Ukraine (Sustainable Aviation Fuel)

Factors	Qualitative assessment		
	S – strong side	N – neutral side	W – weak side
Technologies that meet modern requirements		X	
The presence of innovative capabilities and opportunities for their implementation	X		
Establishing a "green tariff" at the legislative level for renewable energy sources		X	
International commitments of Ukraine within the framework of the Energy Community Treaty and the Association Agreement between Ukraine and the EU and its member states, including the implementation of Directive 2009/28/EC on the promotion of the use of energy from renewable sources		X	
The environmental friendliness of fuel and the absence of pressure on the environment	X		
Energy security	X		
The absence of an approved National Action Plan for the development of renewable energy sources			X
Outdated equipment			X
Lack of specialists with key qualifications and competencies		X	
Presence of internal production issues		X	
Inability to finance necessary changes in strategy			X
Complexity of production (complex process of obtaining)			X
High cost			X
Lack of mass consumer			X
Imperfect storage technologies			X
High cost of SAF		X	
Lack of developed infrastructure for SAF refueling stations			X

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FAME, FAEE AIRCRAFT FUEL SYSTEMS CONTAMINATION PROBLEM

FAME,
FAEE

Methyl esters of fatty acids (FAME), ethyl esters of fatty acids (FAEE) are bioadditives for jet fuel. There is no standard with FAME, FAEE yet. FAME, FAEE – products obtained from vegetable oil (*Camelina sativa* or (*Brassica napus*) rapeseed) by processing them with methyl or ethyl alcohol. The **Chemmotological Scientific School** has developed a recipe, conducted laboratory and operational tests of alternative fuels **BIO JET 10, BIO JET 20** (based on Rapeseed and Camelina sativa oils, and ethyl alcohol). Tests have shown full compliance with the quality requirements according to the standard ASTM D1655. Accordingly, the operation of the engine on such fuel can be considered acceptable. But, FAME, FAEE products with a short life cycle (3 months). After decomposition, it exfoliates in the main fuel, forming clumps of dense rubbery mass. **The quality level is significantly reduced!**

Accordingly, the chemical reliability of the aircraft is not ensured!

THEREFOR ANY KIND OF SAF SHOULD PROVIDE

1. Do not cause a decrease in quality and negative consequences from the use both in pure and in mixed form;
2. Transportation by the existing infrastructure for the supply of fuel, including the pipeline system;
3. Using the existing refueling infrastructure;
4. The use of alternative biofuels in modern fuel-consuming devices, both in pure form and in mixing in any proportion with existing fuels of similar brands.

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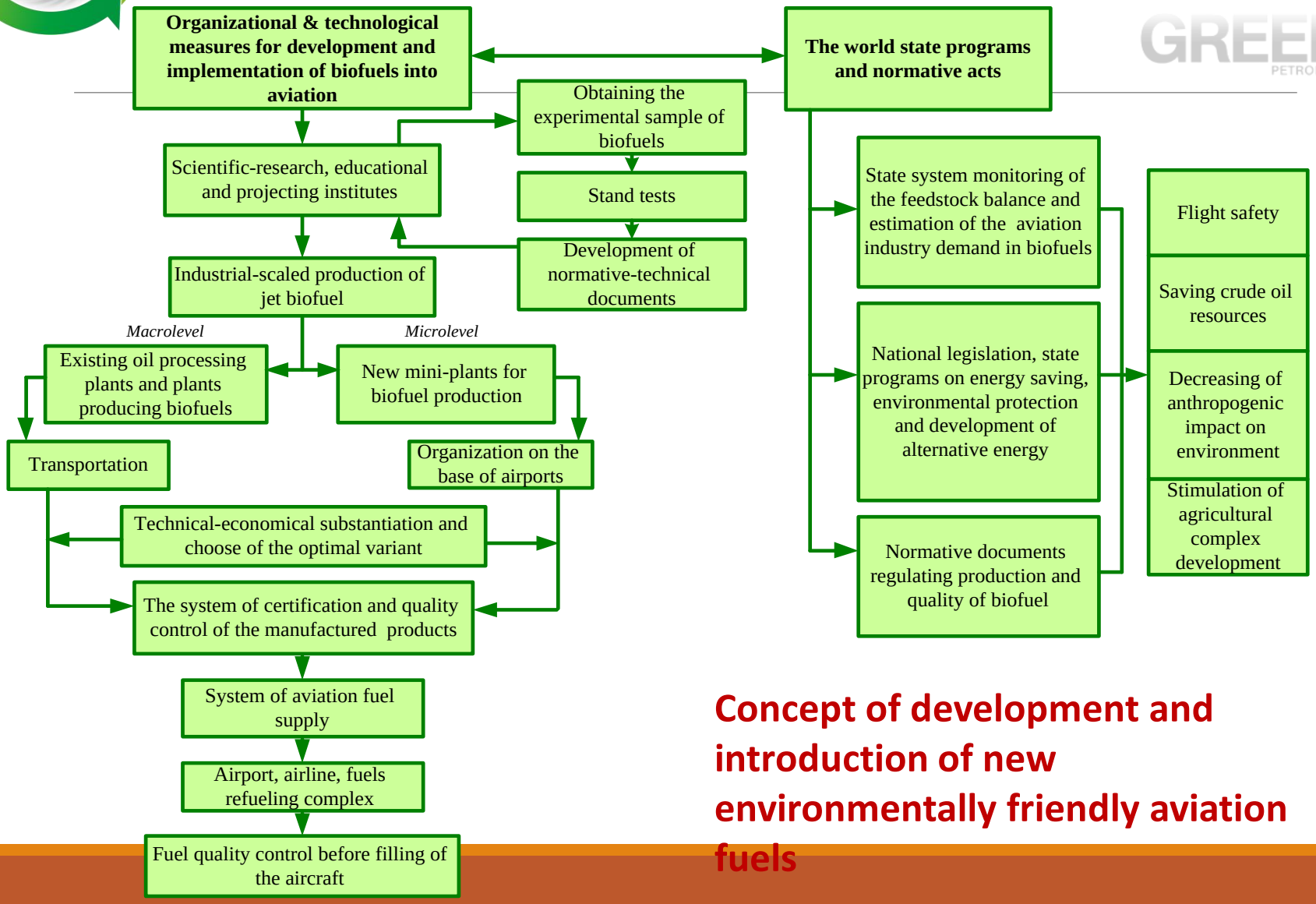
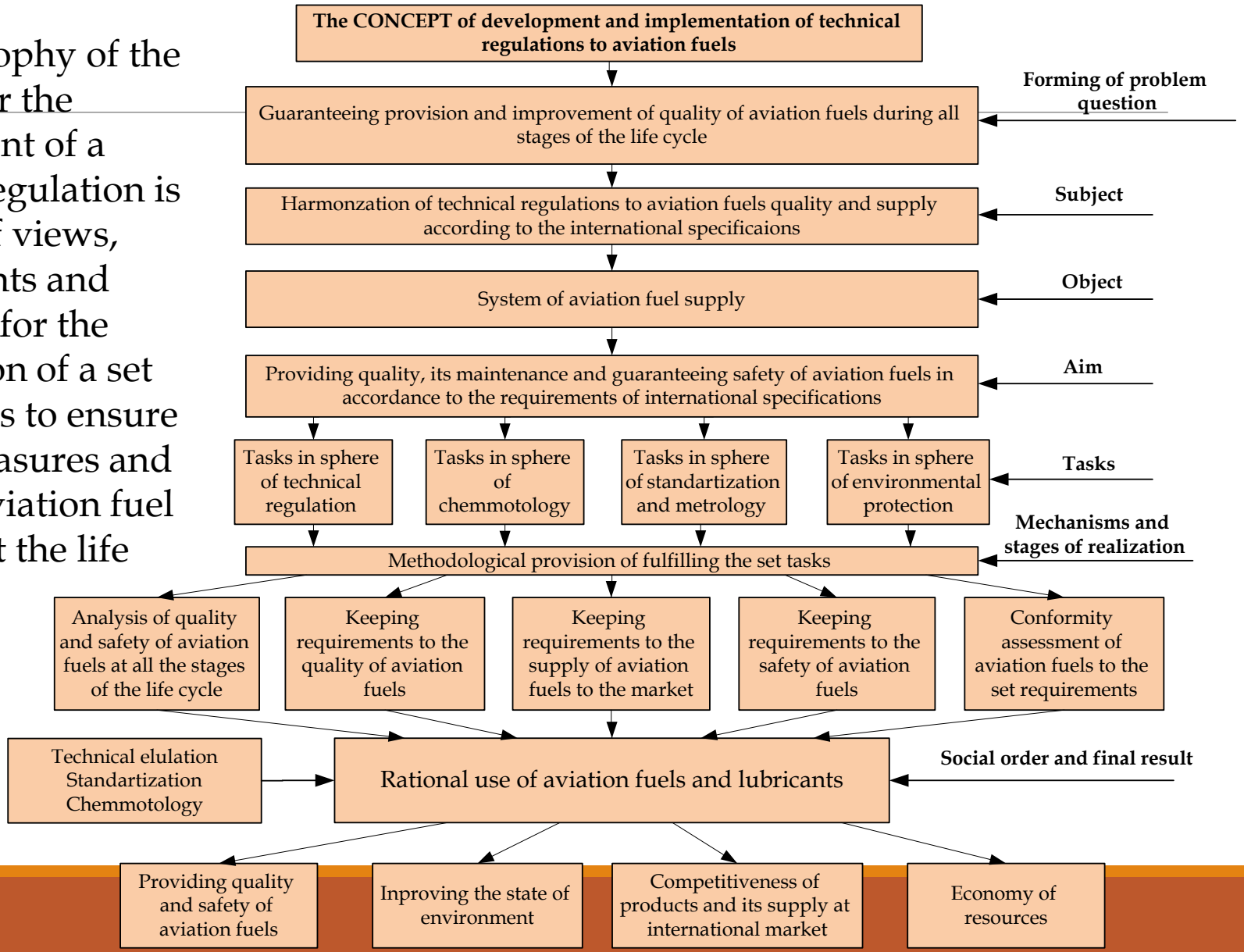


Concept of development and introduction of new environmentally friendly aviation fuels

Prospects for the production and use of SAF in the aviation industry

The philosophy of the Concept for the development of a technical regulation is a system of views, requirements and conditions for the organization of a set of measures to ensure quality measures and safety of aviation fuel throughout the life cycle.



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Conclusions

1. Modern aviation is one of the main consumers of fuel of petroleum origin: aviation gasoline and fuel for jet turbine engines.
2. The system of technical regulation in this area, as well as in the aviation fuel supply system, is imperfect and at the moment is in a state of reformation.
3. The situation with the introduction of technical regulations for the requirements for aviation motor fuels has become urgent today. Implementation of the technical regulations will provide an opportunity to further management of relations in the fields of production, supply, quality control, consumer protection and compliance with the requirements of legislation in aviation fuel supply.
4. We developed and proposed recipes (formulas) of AMF for jet engines of the code brands BioJet-10, BioJet-20, BioJet-30 and also unleaded gasoline 100 UL.
5. We developed the Concept of the development and introduction of environmentally safe jet fuel and unleaded gasoline;
6. After a series of laboratory tests successfully initial tests regarding the operation of the jet engine of the type RU19A-300 using AMF with the code brands «**BioJet 10**», «**BioJet 20**», «**BioJet 30**» and unleaded gasoline **100 UL**.

Chemmotological Reliability in the use of Sustainable Aviation Fuels

Thanks for Your Attention and Cooperation!
We will be glad for Cooperation!

Sincerely,
professor Sergii V. Boichenko

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