

# Modern Trends of Aviation Logistics Development – Effectiveness, Safety and Security Aspects

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Improvement of international aviation logistics is one of the basic instruments of airlines commercial activity under constant increase of aircraft operating costs and tough competition. This research paper discusses modern trends of aviation logistics development. Special attention is paid to efficiency, safety and security of the world aviation logistics system.

**Keywords:** aviation logistics, effectiveness, efficiency, safety, security, cargo, airlines.

## 1. INTRODUCTION

The term air cargo is also used in a broader sense by the airline industry to mean any property (freight, express and mail) transported by air except baggage. All-cargo service is an air service that carries cargo only, no matter if it is scheduled or non-scheduled. In the field of international air transport, attention is often paid to passenger air services, yet air cargo is also an important component of air transport. To many States, air cargo services are important to their national development and international trade, for example, landlocked countries and States which main export commodities have been of high value goods or perishables. To freight shippers, air services render a competitive alternative to other types of transport (rail, trucking or shipping) to meet their shipping requirements in terms of safety, security, efficiency (speed, quality (much less en-route damage)) and cost. As more companies adopt the philosophy of “just in time” (i.e. the goods arrive when needed for production or for use rather than being stockpiled and becoming expensive inventory), an aircraft will be getting more popularity as, in effect, airborne extensions of warehouses in order to reduce inventory carrying cost. For airlines, air cargo service might become as an effective generator. On some major international routes (e.g. across the North Atlantic, between Europe and

Asia and across the North/Mid Pacific), air cargo service has contributed to, as it is estimated, one-fifth of the total revenue on international scheduled air services. A more recent development achievement that adds importance to air cargo is the huge expansion of the courier and express/small package business, which offers door-to-door air service for time-sensitive documents or small packages based on the delivery guaranteed time limits (e.g. same day or next day) but subject to size or weight limitations. Some airlines have also become more involved in door-to-door services, rather than limiting themselves to provision of the air component. Air cargo transportation has become increasingly integrated and globalized via cross-equity investments between airlines and cooperative arrangements such as co-branding and franchising. This chapter identifies some distinct features of air cargo transportation and provides information on how governments regulate air cargo operations. Air cargo tends to use more intermodal transport, i.e. more than one form of transport, e.g. airplane, truck, rail or ship between origin and destination (see Fig 1) [1].

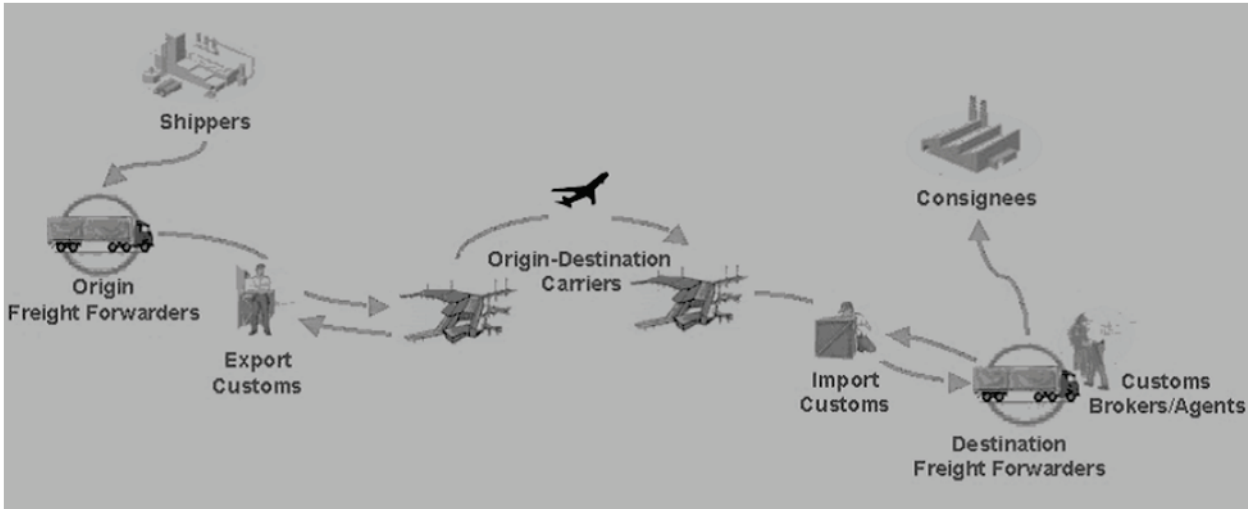


Fig. 1. Scheme of aviation logistics cargo transportations [2].

2. TRENDS AND FORECASTS OF AIR CARGO TRANSPORTATIONS EFFICIENCY AND EFFECTIVENESS

Leading international governmental (International Civil Aviation Organization (ICAO)) and non-governmental (International Air Transport Association (IATA)) organizations, major aircraft manufacturers such as Boeing and Airbus are involved in air cargo logistics market forecasting. The analysis of these forecasts can explore performance metrics of global logistics system and identify hazards and risks of their dynamic development.

2.1. INTERNATIONAL CIVIL AVIATION ORGANIZATION LONG TERM AIR CARGO FORECAST

The econometric analysis, together with the assumptions mentioned earlier, resulted in a “most likely” projected growth rate of 6.6 per cent per annum for world scheduled freight tonne-kilometres for the period 2005–2025. This is about the same growth registered for the 1985–2005 period. Alternative assumptions concerning the underlying factors affecting air freight suggest a band of forecast growth rates ranging from a “low” of 4.9 per cent per annum to a “high” of 7.8 per cent per annum as illustrated in Figure 2. Table 1 presents the ICAO forecasts of scheduled freight traffic (including international and domestic components) in terms of both tonne-kilometres performed and tonnes carried. International freight traffic is expected to grow more rapidly than domestic freight traffic, due partly to the relatively fast growth of

international commerce. Domestic freight is dominated by the more mature market of the United States, and this is another reason for the moderate growth of total domestic traffic. Freight tonnes carried are expected to grow more slowly than freight tonne-kilometres because of a continuing increase in the average length of haul [3].

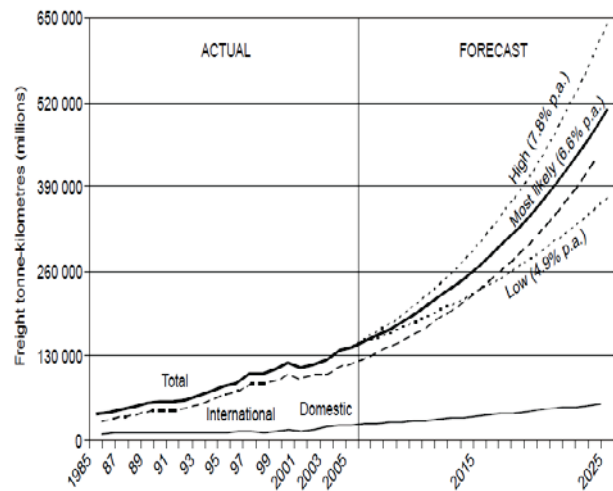


Fig. 2. Trends in scheduled freight traffic – World (1985 – 2025) (ICAO Contracting States)[3].

Table 1. ICAO scheduled freight traffic– World (1985 – 2025) (ICAO Contracting States)[3].

	Actual 1985	Actual 2005	Forecast 2025	Average annual growth rate (per cent)	
				1985-2005	2005-2025
<b>Freight tonne-kilometres (millions)</b>					
Total	39 813	142 580	510 000	6.6	6.6
International	29 384	118 480	452 120	7.2	6.9
Domestic	10 429	24 100	57 880	4.3	4.5
<b>Freight tonnes carried (thousands)</b>					
Total	13 742	37 660	145 000	5.2	5.5
International	5 884	22 630	110 000	7.0	6.5
Domestic	7 858	15 030	35 000	3.3	3.4

Source: ICAO.

2.2. INTERNATIONAL AIR TRANSPORT ASSOCIATION SHORT TERM AIR CARGO FORECAST

Global cargo markets are expected to finish 2012 0.4-percent behind 2011 levels, according to International Air Transport Association projections. Increased air freight capacity amid sluggish trade volumes has led to IATA’s more “pessimistic” projections regarding cargo yields; the association anticipates air freight yields lagging 2-percent behind 2011 levels. These figures are below previous IATA projections. Earlier this year, IATA anticipated a 0.3-percent, year-over-year, surge in cargo traffic for the full year and flat cargo yields. In a press release, IATA attributed the latter downgrade to worldwide discrepancies between supply and demand. Cargo capacity in the first eight months of 2012 was 3-percent higher than demand, a problem directly tied to belly-hold operations. Since roughly half of all airfreight is carried in the bellies of passenger craft, matching cargo capacity to demand is difficult, according to the press release. Such problems will likely plague air freight markets in 2013. According to association projections, cargo markets will see yields drop by 1.5 percent in 2013, despite a resurgence in world trade. Global trade levels are projected to swell 5.1-percent, year-over-year, in 2013, ahead of the 3.4-percent, year-over-year, increase projected for 2012. Overall, however, IATA revised upward its global aviation outlook for 2012. IATA projects that airlines will earn \$4.1 billion in 2012, \$1.1 billion more than the association predicted in June.

The association also projects global profits increasing to \$7.5 billion in 2013, although the net margin is only 1.1 percent [4].

2.3. BOEING LONG TERM CARGO FORECAST

World air cargo traffic growth detail International air freight will drive overall world air cargo growth through 2031. Over the next 20 years, world air cargo traffic will grow 5.2% per year. Air freight, including express traffic, will average 5.3% annual growth, measured in RTKs. Air mail traffic will grow much more slowly, averaging only 0.9% annual growth through 2031. Overall, world air cargo traffic will increase from 202.4 billion RTKs in 2011 (down from its 2010 record of 204.2 billion RTKs) to more than 558.3 billion RTKs in 2031. Asia will continue to lead the world air cargo industry in average annual growth rates, with domestic China and intra-Asia markets expanding 8.0% and 6.9% per year, respectively. Latin America markets with North America and with Europe will grow at approximately the world average growth rate, as will Middle East markets with Europe. The more mature North America and Europe markets reflect slower and thus lower-than-average traffic growth rates - 8,000RTKsin billion. World air cargo traffic will more than double over the next 20 years. (see Fig. 3 and Table 2) [5].

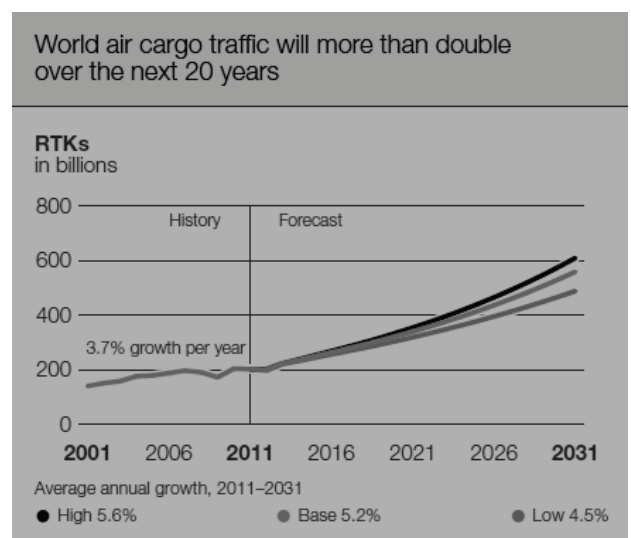


Fig. 3. Boeing long term world cargo forecast[5].

Table 2. Boeing long term regional cargo forecast[5].

Historical and forecast air cargo growth rates		
	Historic 10 years 2001–2011	Forecast 20 years 2011–2031
World	3.7%	5.2%
Intra-North America	-1.5%	2.3%
Latin America–North America	1.8%	5.6%
Latin America–Europe	3.2%	5.3%
Europe–North America	1.5%	3.5%
Intra-Europe	1.6%	2.4%
Middle East–Europe	9.5%	5.7%
Africa–Europe	3.2%	4.8%
Asia–North America	4.3%	5.8%
Europe–Asia	6.2%	5.7%
Intra-Asia	4.5%	6.9%
South Asia–Europe	6.1%	5.8%
Domestic China	10.9%	8.0%

2.4. AIRBUS LONG TERM CARGO FORECAST

Positive trends of the global freight market are also confirmed by the forecasts of leading European aircraft manufacturer consortium Airbus. The figures show Airbus long term world cargo forecast [see Fig. 4] and Airbus long term freighter aircrafts forecast[see Fig. 5] until 2030 [6].

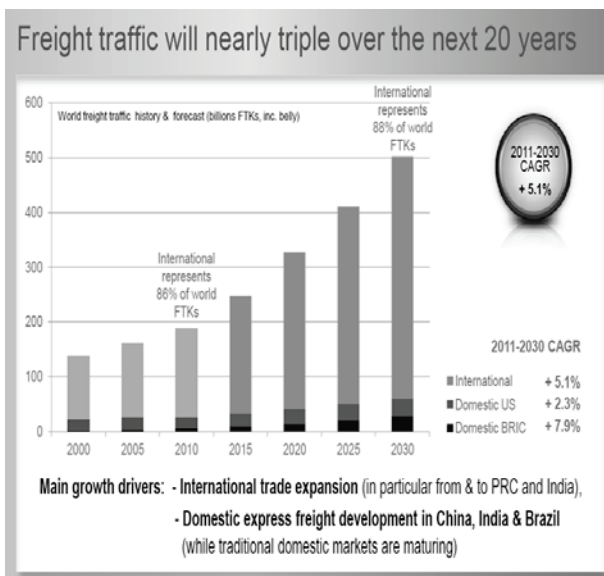


Fig. 4. Airbus long term world cargo forecast[6].

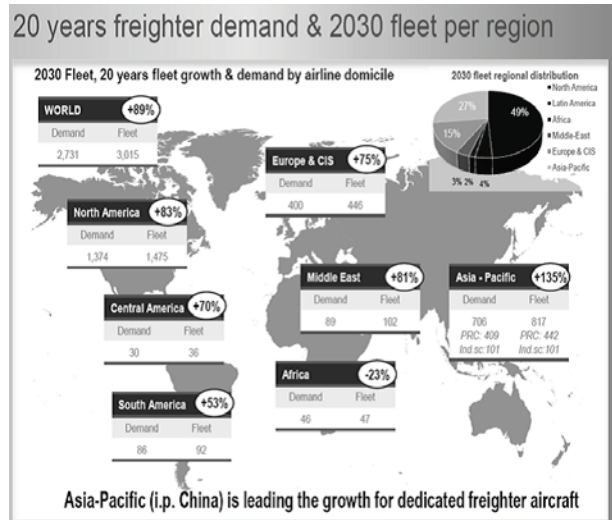


Fig. 5. Airbus long term freighter aircrafts forecast[6].

3. SAFETY AND SECURITY ISSUES OF AVIATION LOGISTICS DEVELOPMENT

The main target of worldwide aviation activity is safety. According to ICAO, safety is the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management [7]. Nowadays global aviation logistics system are forming progressive component of general transport system and at the present time ICAO, IATA, regional and national organizations such as European aviation safety agency (EASA), EUROCONTROL, government and airspace branch are conducting operations connected with their improvement. However, the increase in freight traffic and number of cargo flights increases the hazards and risks for safety, security and environmental protection.

From viewpoint of ICAO the purpose of world aviation logistics system is to create international normative data base in accordance with Standards and Recommended Practice (ICAO SARPS). The term “safety management” includes two key concepts. First is the concept of a State Safety Programme (SSP), which is an integrated set of regulations and activities aimed at improving safety. Second is the concept of a Safety Management System (SMS) which is a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures. States are required to establish an SSP to include safety rulemaking, policy development and oversight. Under an SSP, safety rulemaking is based on

comprehensive analyses of the State's aviation system. Safety policies are developed based on safety information, including hazard identification and safety risk management, while safety oversight is focused on the effective monitoring of the eight critical elements of the safety oversight function, including areas of significant safety concerns and higher safety risks. It should also determine what role, if any, "equivalent level of safety" and "acceptable means of compliance" will have.

Security is the second strategic target of worldwide aviation activity development. The main problem is the dynamical growth of aviation logistics system and increasing of number of shippers and consignees, which are involved in the aviation logistics transportation. In connection with this problem 37 ICAO Assembly decided to include aviation logistics in the scope of aviation security. At present, we can identify the following areas of security for world logistics system: Physical security - aircraft protection; tampering; access control to logistics infrastructure. Cyber security - same standards as for CNS systems: protection of software and data links from hacking; spoofing; interference or malicious hijack.

### *3.1. EUROPEAN COMMISSION INITIATIVES*

The international focus on security tightened considerably since the terrorist attacks in 2001 which have changed to world in which we live. That is why the concept of security (security and safety) is now included in the European Customs legislation. Companies involved in the European Union external borders movements of goods and their suppliers, are particularly exposed to this legislation. With the introduction of this legislation, the European Union simultaneously wants to provide trade with better facilities. One of these facilities is the status of an Authorized Economic Operator (AEO), which would lead to a number of benefits such as fewer logistical delays, reduced administrative burdens and priority treatment for customs controls for AEOs in return for meeting a strict security and safety criteria.

Within the SAFE Framework of Standards to secure and facilitate global trade of the World Customs Organization (WCO), the AEO is defined as a party involved in the international movement of goods in whatever function that has been approved by or on behalf of a national Customs administration as complying with WCO or

equivalent supply chain security standards. Authorized Economic Operators include inter alia manufacturers, importers, exporters, brokers, carriers, consolidators, intermediaries, ports, airports, terminal operators, integrated operators, warehouses, distributors.

The AEO is a concept that aims at balancing increased security requirements with facilitation for compliant traders. It constitutes a main element of the Customs security Program of the European Union.

The European Customs legislation is in compliance with the WCO SAFE Framework which is in fact the global standard for customs supply chain security. In addition, the EU AEO program is similar to other European Union programs aimed at improving security, such as Regulated agent, the Known consignor and the Account consignor as defined in article 3 of the EU regulation 300/2008 on common rules in the field of civil aviation security.

### *3.2. U.S. INITIATIVES*

In response to potential terrorist threats, the U.S. Customs authorities have taken initiatives to improve security in the international supply chain. One of these initiatives is the Container Security Initiative (CSI), which pre-selects, according to risk assessment criteria, containers destined for the USA prior to loading on the ship in a foreign port. CSI is currently operational in a large number of ports worldwide. The U.S. has also published a regulation on advanced cargo manifest information, the so-called '24 hour rule'. This regulation obliges carriers to provide electronic manifest data to US Customs, at least 24 hours before loading sea containers bound for the USA. For air cargo, information should be made available immediately after take-off for short-haul flights and at least 4 hours prior to arrival for long-haul flights. This enables US Customs to select high-risk shipments via their automated target system. US Customs have also introduced the Customs and Trade Partnership against Terrorism (C-TPAT) programme comparable with the EU and WCO AEO programmes. The US and the EU are currently working towards the mutual recognition of both programmes.

### 3.3. CANADA INITIATIVES

The Free and Secure Trade (FAST) programme is a joint Canada-U.S. initiative. FAST supports moving pre-approved eligible goods across the land border quickly and verifying trade compliance away from the border. It is a harmonized commercial process offered to pre-approved importers, carriers, and registered drivers. Shipments for approved companies, transported by approved carriers using registered drivers, will be cleared into either country with greater speed and certainty, and at a reduced cost of compliance. Canada has developed the "PIP" (Partners in Protection Program) that is comparable to C-TPAT and AEO. The US and Canada have on 28 June 2008 signed an arrangement on mutual recognition of C-TPAT and PIP. The EU and Canada envisage strengthening their cooperation on supply chain security and AEO.

### 3.4. AUSTRALIA INITIATIVES

In Australia Customs and trade work together to protect Australia. Frontline is a cooperative programme between Customs and trade groups involved in international trade and transport. The programme draws on the knowledge and expertise of people in trade to help prevent illegal activities.

### 3.5. NEW ZEALAND INITIATIVES

The Customs Service works with trade on improving export security. One of their programmes is Secure Export Partnership (SEP) to secure New Zealand's in case of a Customs Union such as the EU mutual recognition shall be between the Customs Union and the third country 3A – 18 exports. New Zealand cooperates with the US on mutual recognition of their SEP and the US Customs C-TPAT.

### 3.6. EU-CHINA COOPERATION

The EU and China have signed an agreement on cooperation and mutual assistance in Customs matters. Based on consensus in the EC-China Joint Customs Cooperation Committee, both sides agreed to closely cooperate on supply chain security. A pilot project on smart and secure trade lanes is currently in progress. Part of this pilot is the exchange of information as well as of close cooperation on AEO matters to pave the way for

reciprocity and mutual recognition of security measures, including the mutual recognition of the AEO programmes in the EU and China. China implemented the AEO concept as of 1 April 2008; both sides aim at achieving mutual recognition of AEO in 2010. The WCO Framework of Standards is used as a global principle on which to develop programs and cooperate with other countries.

### 3.6. EU - JAPAN COOPERATION

The EU and Japan are currently working towards mutual recognition of the EC and Japan AEO. This cooperation is based on conclusions of the EC-Japan Customs Cooperation Committee where consensus was reached between the EC and Japan to strive for mutual recognition of both sides programs. The target date is 2010.

### 3.7. EU - SWITZERLAND AND NORWAY COOPERATION

The EU and Switzerland and the EU and Norway reached an agreement on the implementation of equivalent security programs.

### 3.8. JORDAN - US

Jordan and the US signed in June 2007 an arrangement on mutual recognition of their Golden Client Program with the US C-TPAT.

### 3.9. US-JAPAN AND US-KOREA

Recently the US and Japan as well as the US and Korea have reached mutual recognition agreements of their respective security programs [2].

## 4. THE ROLE OF UKRAINIAN AND POLISH UNIVERSITIES AND SCIENTIFIC-RESEARCH INSTITUTIONS IN THE PROCESS OF WORLD AIR LOGISTICS SYSTEM EFFECTIVENESS AND SAFETY IMPROVING

Taking into account the abovementioned, the scientists from National Aviation University (NAU) (Ukraine) during last decades have been working out theoretical principles, concept, technical and process solutions for realization the program of safe implementation of aviation logistics system into the practice of civil aviation. The main task of NAU scientist is to conduct

fundamental theoretic research performance in the sphere of safety - security control and efficiency application of world logistics system. Department of Logistics of National Aviation University is a separate educational and research subdivision. It was the first Logistics Department in Ukraine.

The International University of Logistics

founded in 2001 by the Association for Building Integrated Logistics

reason for founding such an establishment resulted from the observed shortage of higher education vocational institutions that would educate future logistics specialists or forwarders. The mission of the MWSLiT is to educate future managers able to run modern logistic processes and open to challenges of integrated Europe. Thanks to cooperation with their key partner – ESIDEC group of schools from Metz, France – the tuition program of the University provides comprehensive knowledge and qualifications in the field of broadly understood logistics, transport and forwarding. The international profile of the University as well as relations with foreign partners allow them to run “open education” by means of guest lectures of both Polish and international academics.

Next step of development of aviation logistics research activity is the establishment of the Polish-Ukrainian Research Institute. The mission of institute is the organization of collaborative work of Ukrainian and Polish scientists. Differences and powerful of famous aviation logistics schools is the most significant factor which will leads to multivectoring of joint research activity. Collaborative research can be devoted to logistics safety, security and effectiveness, use of modern technology in logistics processes, the efficiency and effectiveness of remotely piloted aircraft systems using in logistical problems solving due to territorial infrastructure, aerospace navigation technologies in logistics, improvement of theoretical foundations of high-definition coordinate in real time in satellite navigation systems, development of the systems of monitoring and management of vehicles, satellite geodesic technologies, systems engineering in logistics, information technologies and simulators in logistics, ecology and environmental protection in logistics etc.

## 5. CONCLUSIONS

Forecasts of the leading organizations in the field of civil aviation and aircraft manufacturers point to the growth of global air cargo traffic. These trends make it necessary to increase level of safety, security and efficiency of aviation logistics. These issues solved by World Customs Organization, International Civil Aviation Organization and International Air Transport Association, regional and national organizations such as European aviation safety agency (EASA), EUROCONTROL, government such as Federal Aviation Authorities (USA) and Civil Aviation Authorities and airspace branch.

The complex issue of world aviation logistics system safety, security and effectiveness aspects is the basis for their integration into the global aviation and transport systems. The leading role in this process should play universities and international research institutions. In this regard, joint research activities of the two leading logistics schools of Ukraine and Poland in the frame work of the Polish-Ukrainian Research Institute is the key to further development of this modern innovative direction of transport activities.

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