ICAO

ICAO Long-Term Traffic Forecasts

Passenger and Cargo

July 2016

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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METHODOLOGY

1. BACKGROUND

1.1 With a view to responding to the needs of States, regional air navigation planning groups and environmental planning bodies, several sets of long-term traffic forecasts were developed under the auspices of ICAO over the past decade. In considering this development and the resulting complexities, Resolution A38-14 requested the Council to "develop one single set of long-term traffic forecasts, from which customized or more detailed forecasts can be produced for various purposes, such as safety, air navigation systems planning and environmental analysis".

1.2 The Multi-disciplinary Working Group on Long-term Traffic Forecasts (MDWG-LTF) under the Aviation Data and Analysis Panel (ADAP) was tasked to develop a single set of long-term traffic forecasts. The MDWG-LTF comprised of ten Member States and three international organizations. The membership of MDWG-LTF also included five members of the Committee of Aviation Environmental Protection (CAEP) working groups. The work of the group has resulted in the replacement of ICAO's decade-old simple forecasting techniques with more rigorous econometric models.

2. DATA AND MODEL SPECIFICATION FOR PASSENGER AND CARGO FORECAST

2.1 A time-series data set of Revenue Passenger Kilometres (RPK) and Freight Tonne Kilometres (FTK) was created for both international and domestic operations at city pair and carrier levels from 1995 to 2012 by compiling:

a) actual traffic data reported by States to ICAO (through the Air Transport Reporting Forms A, B and C) and published directly by States, the coverage of which was over 90 per cent of air passenger traffic and 95 per cent of freight traffic; and

b) estimated traffic data based on the airline schedules published in the Official Airline Guide (OAG), which was used to fill the gaps.

2.2 This initial data set was subsequently reconciled with operations data in the Common Operations Database (COD) maintained by the CAEP in order to establish common baseline traffic volumes for the year 2012.

2.3 While the previous passenger traffic forecasts made in 2013 by the CAEP consisted of 32 route groups, the MDWG-LTF decided to segment passenger forecasts into a total of 50 route groups (40 international and 10 domestic, Appendix refers). In order to obtain the flexibility of having different elasticity estimates based on income level and market maturity, these 50 route groups were assigned to six different tiers based on the World Bank definitions of low, lower-middle, upper-middle and high-income economies (http://data.worldbank.org/about/country-and-lending-groups)[1]. Concerning freight forecasts, since nearly 80 per cent of the traffic moves in the East-West trade lane, it was decided to use six regions instead of the 50 route groups.

2.4 The specification of the appropriate dynamic demand equations followed economic theories and a "general to specific" approach that starts with a model which is over parameterised[2] and then simplifies to a more specific form on the basis of statistical tests and the overall explanatory power of the model. After a series of diagnostic tests, the equation selected to predict annual change in passenger traffic for each route group is a function of real GDP per capita and cost of travel:

$$\Delta log\widehat{RPKpc}_{rt} = \sum_{i=1,\, j=1}^{6} \beta_i \, (T_j * \Delta logGDPpc_{rt}) + \beta_{oil} \Delta log \;\; Cost\ of\ Travel_{rt} + dummies$$

i: tier coefficient index, j: tier index, t: year, r: route group, pc: per capita, Δ: difference between t and t-1

[1] The 6 tiers are: T1 = both origin and destination are low-income economies; T2 = origin is low-income economies and destination is either lower-middle or upper-middle income economies or vice versa; T3 = origin is high-income economies and destination is low income economies or vice versa; T4 = origin is high-income economies and destination is either lower-middle or upper-middle income economies or vice versa; T5 = both origin and destination are either lower-middle or upper-middle income economies; and T6 = both origin and destination are high-income economies.

[2] Explanatory variables considered and tested include gross domestic product (GDP), income, population, travel cost, international trade volumes and employment.

2.5 As there is no coherent methodology to obtain specific airfare costs, oil prices were used as a proxy for cost of air travel, consistent with recent literature on this topic. In addition, dummy variables are added to the model to take into account the effect of "special" events such as those of September 11th 2001 and the Severe Acute Respiratory Syndrome (SARS) outbreak.

2.6 A panel data analysis using a first difference estimator (i.e. based on difference between year t and year t-1) was used to estimate the passenger traffic equation. This approach best fits the dataset and information available for estimation while allowing for controlling of both time series and cross-sectional aspects of the data.

2.7 Unlike the passenger demand model, the equation of the freight demand for most of the regions includes real GDP per capita as a sole explanatory variable because the estimated coefficients of oil prices were not statistically significant.

$$\widehat{logFTK_t} = \alpha + \beta \ logGDP_t \qquad \text{t: year}$$

2.8 Individual ordinary least squares (OLS) regression was used for each region as it performed better than other approaches.

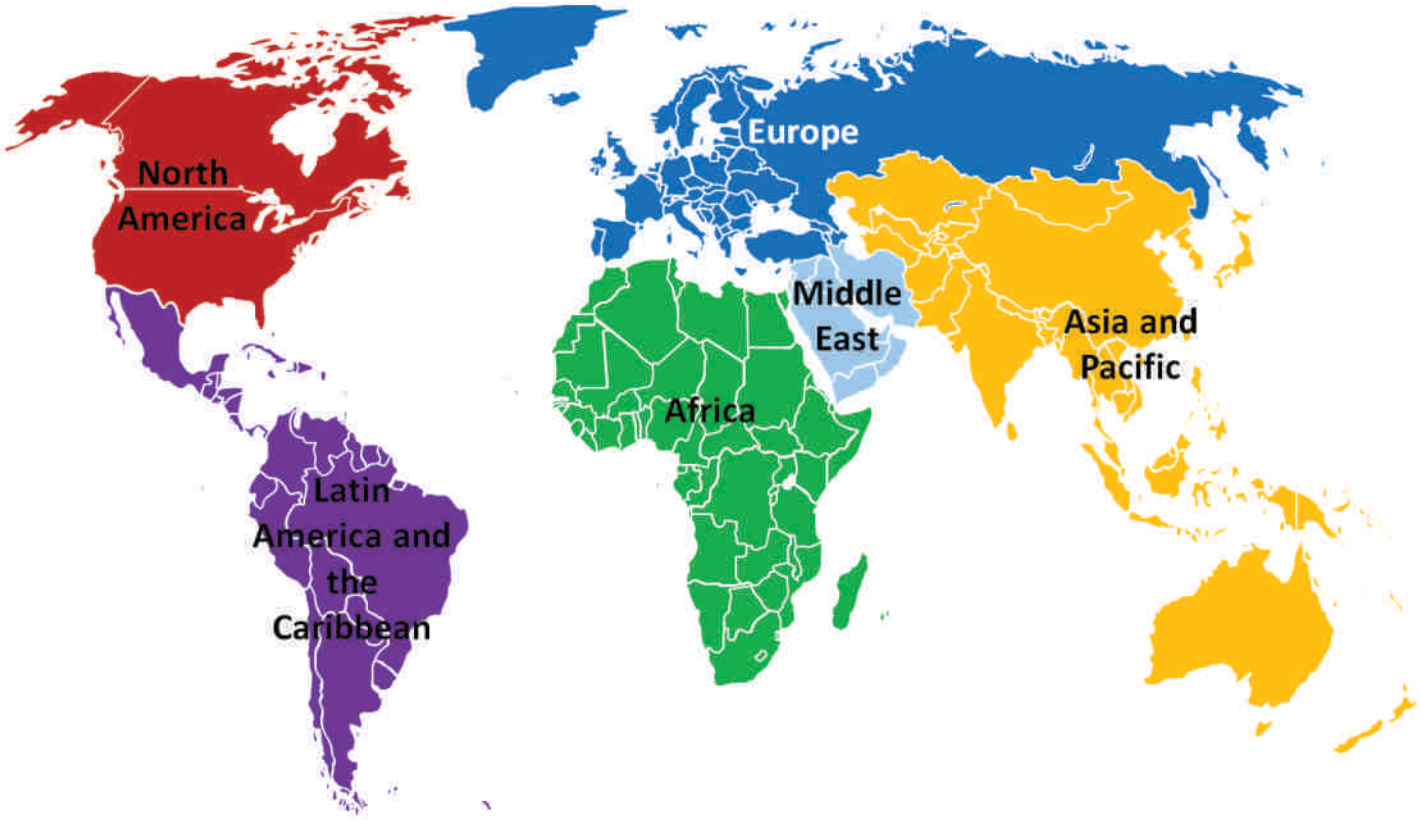
3. RESULTS OF ESTIMATION

3.1 The predicted changes in the RPKs and predicted annual FTKs are used to calculate Compound Annual Growth Rates (CAGR) of passenger and freight traffic for twenty (2012-2032) and thirty (2012-2042) year period. The estimated results are summarized in Appendix to this document.

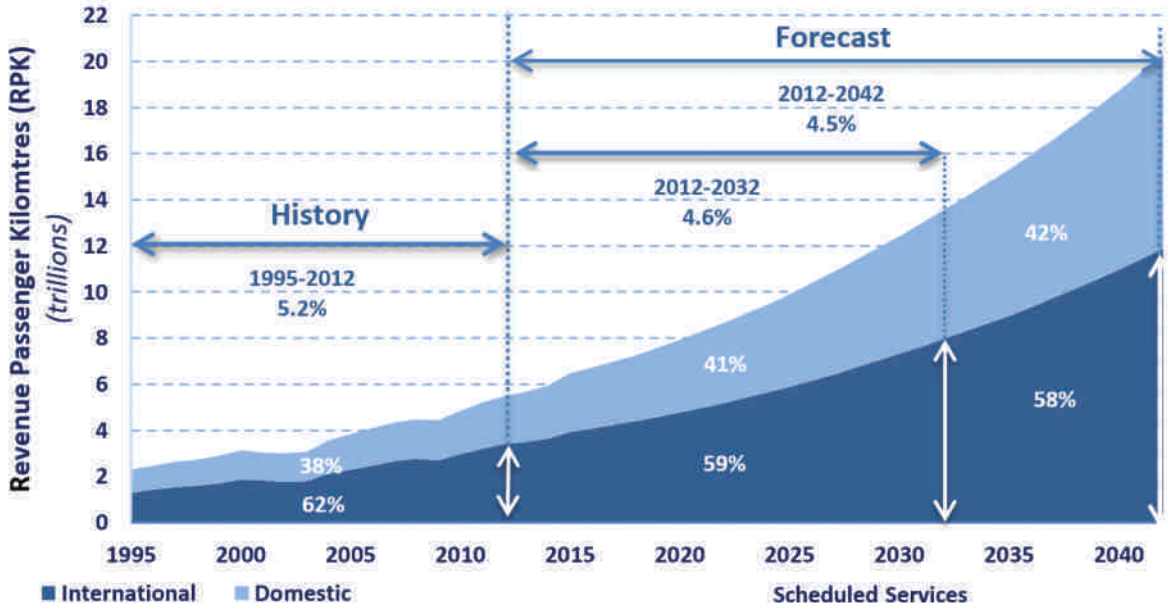
3.2 The estimated results indicate that global passenger traffic will grow at 4.6 per cent annually to 2032. Fourteen route groups outpace the global growth, including all route groups involving Central Southwest Asia. The fastest growing route group is Domestic Central Southwest Asia, which is estimated to grow at around 10 per cent annually. The growth rates of route groups in and between Africa, Central America/Caribbean and Middle East are close to the global growth rate. Route groups in and between mature markets including Europe, North America, and North Asia have a lower estimate of growth rate.

3.3 Global freight traffic is expected to grow at 4.4 per cent annually over the same time period as passenger forecasts. The Middle East has the highest forecast of annual growth outpacing global estimate by about 2.8 percentage points. The growth rate of Asia/Pacific is close to the global estimate, at 4.7 per cent. Europe, Latin America/Caribbean, and North America will grow at a slightly slower pace than Asia/Pacific while Africa has the lowest annual growth rate of 2.1 per cent.

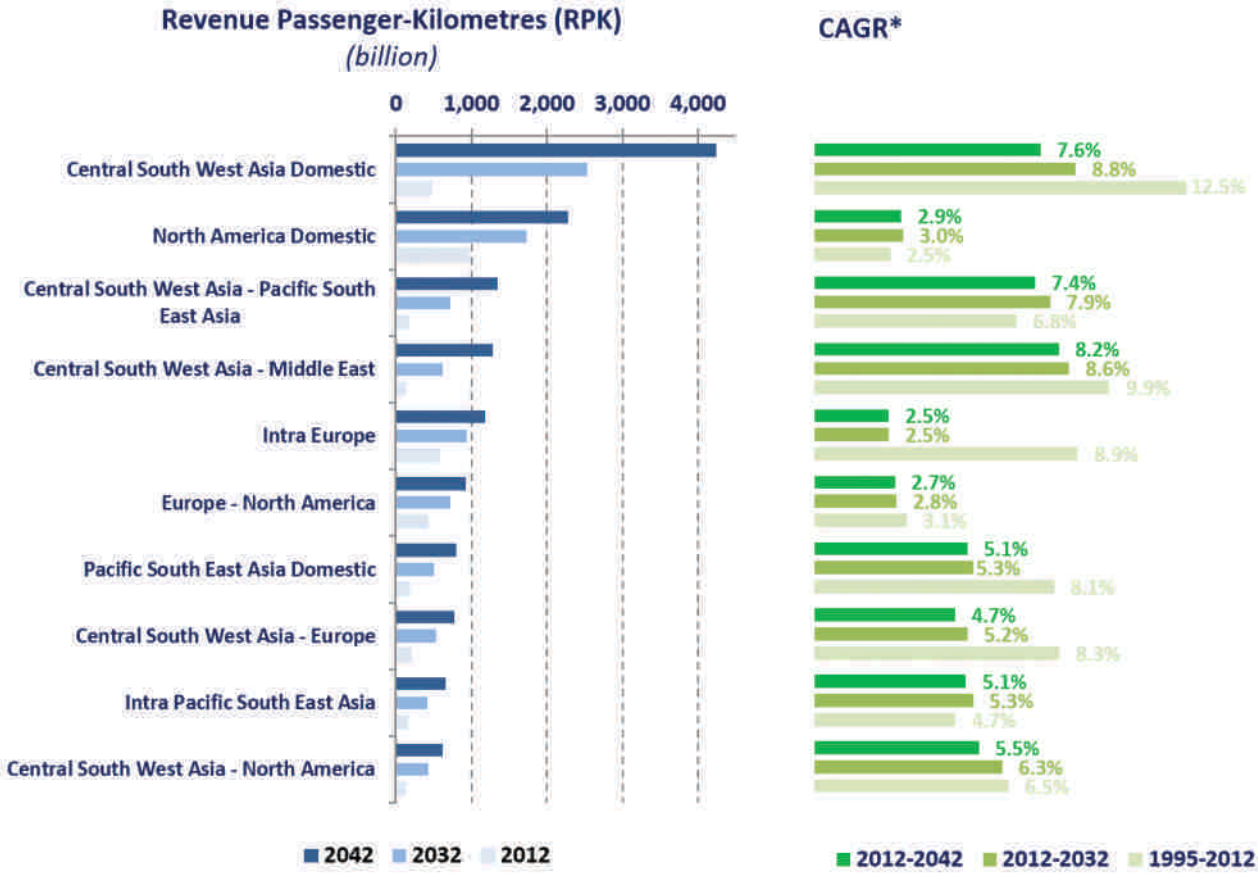
World map of ICAO Regions



Total passenger traffic: history and forecasts

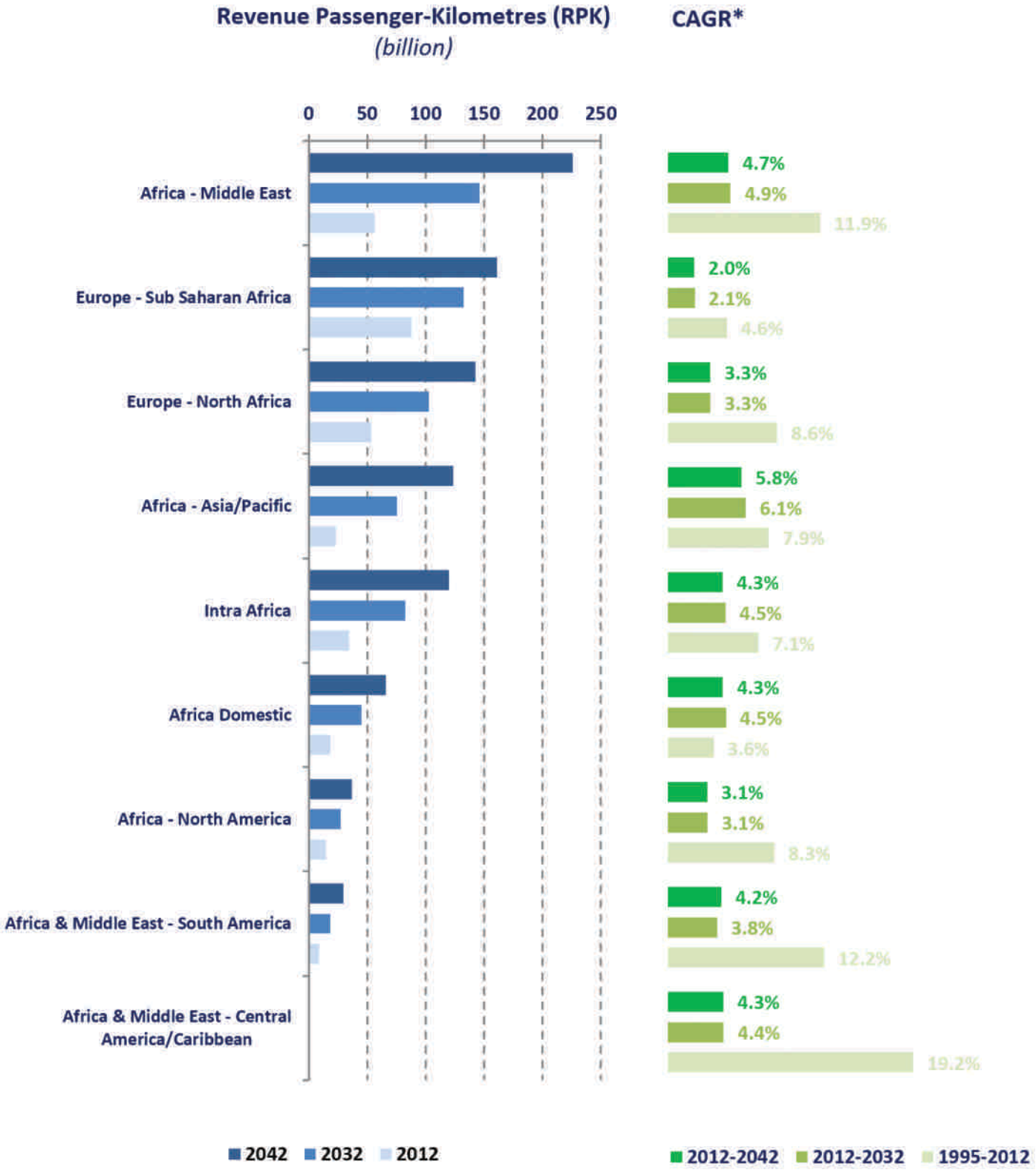


World top 10 passenger traffic by route group: 2012 vs. 2032 and 2012 vs. 2042

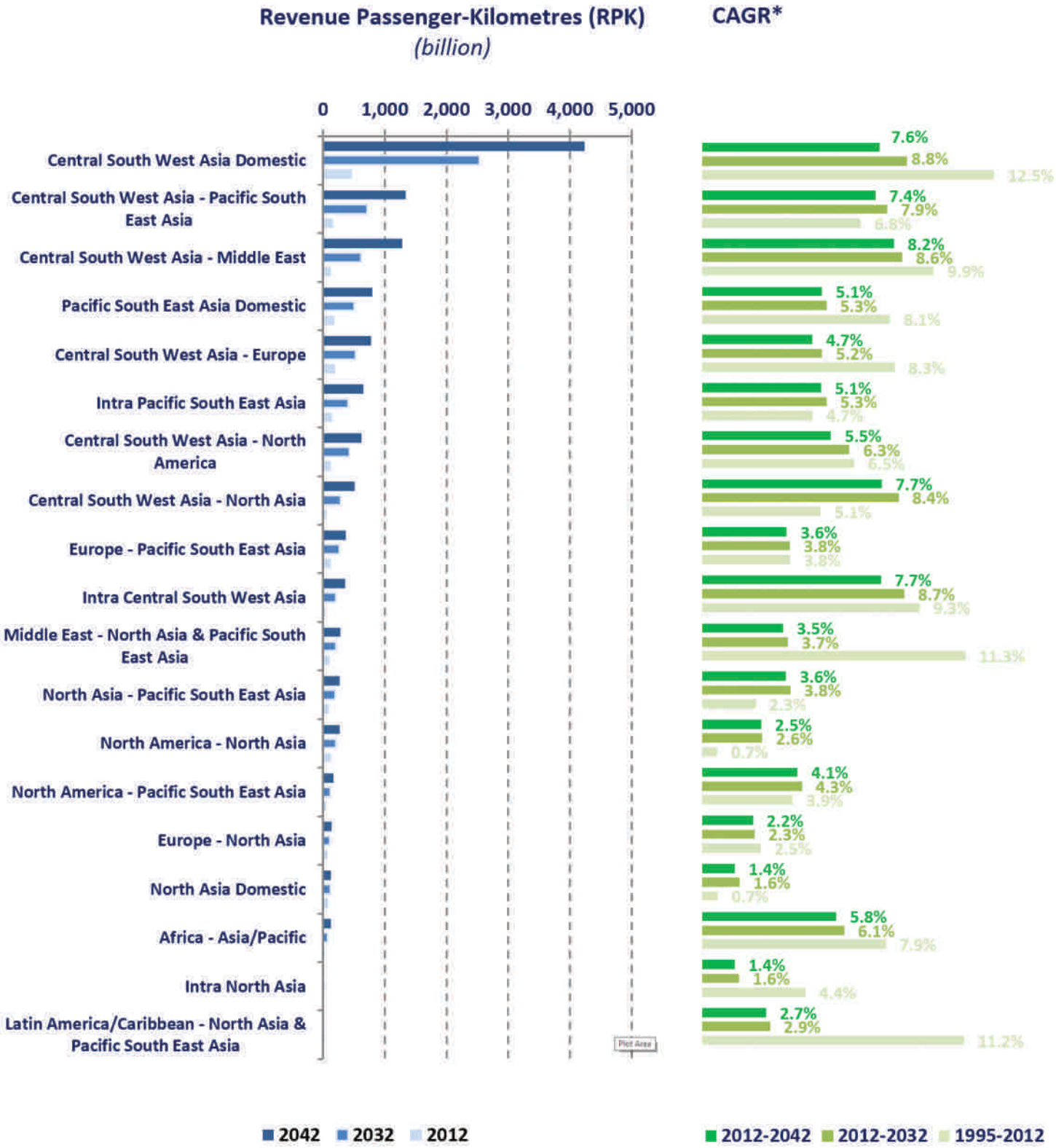


Forecast. Passenger traffic by route group by region: 2012 vs. 2032 and 2012 vs. 2042

Africa

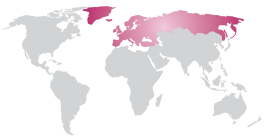


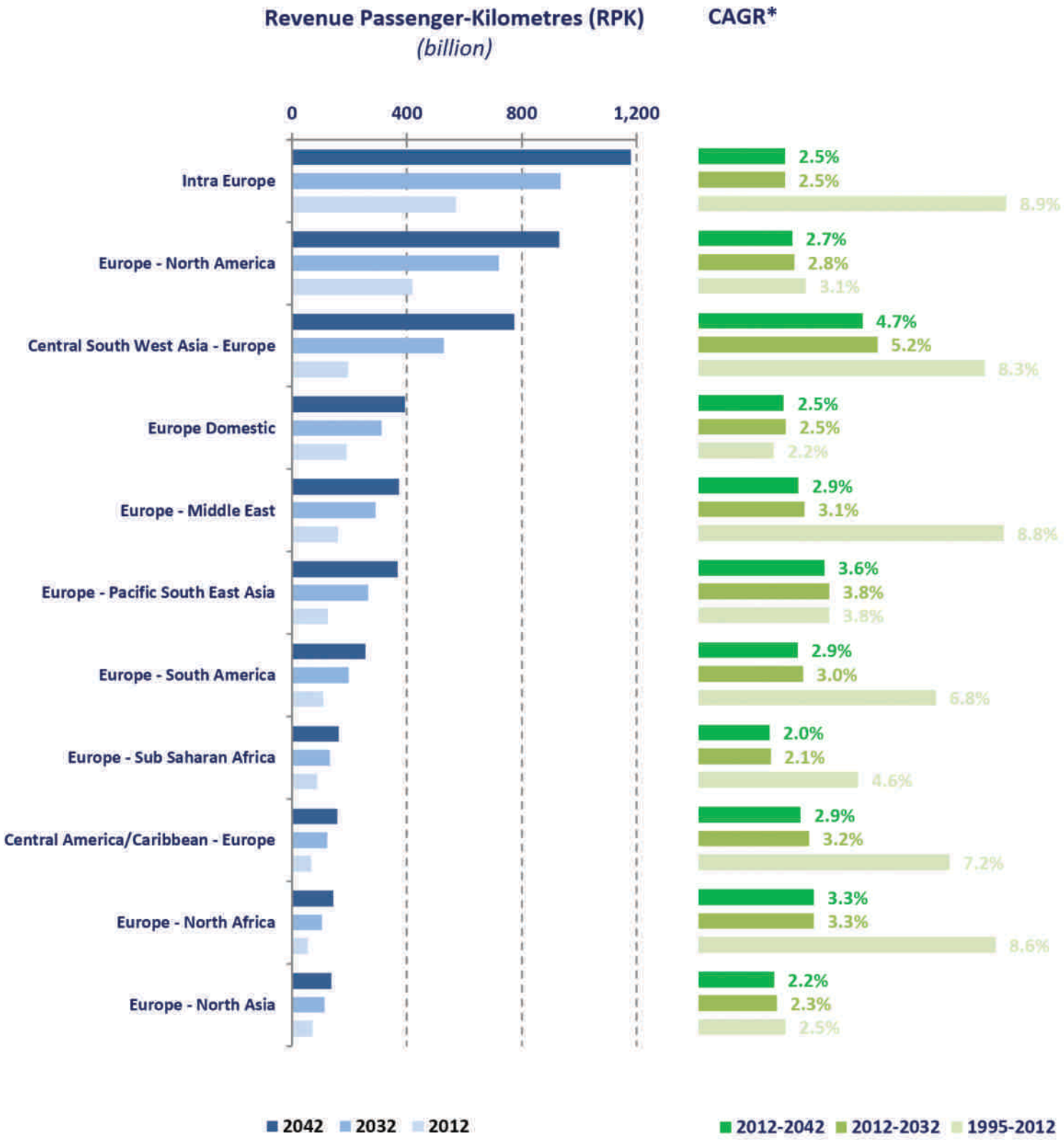
*CAGR: Compound Annual Growth Rate



*CAGR: Compound Annual Growth Rate

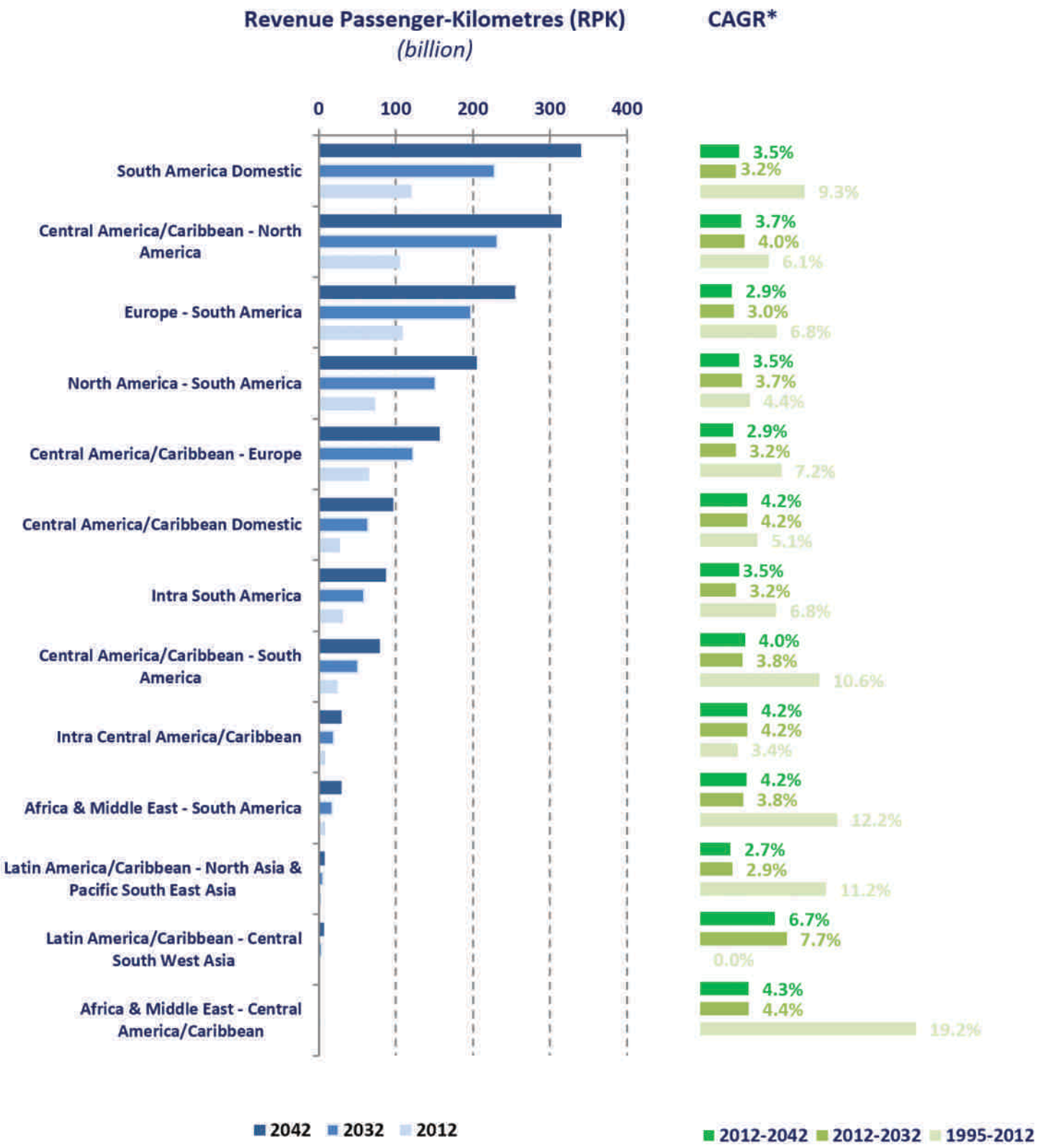
Europe





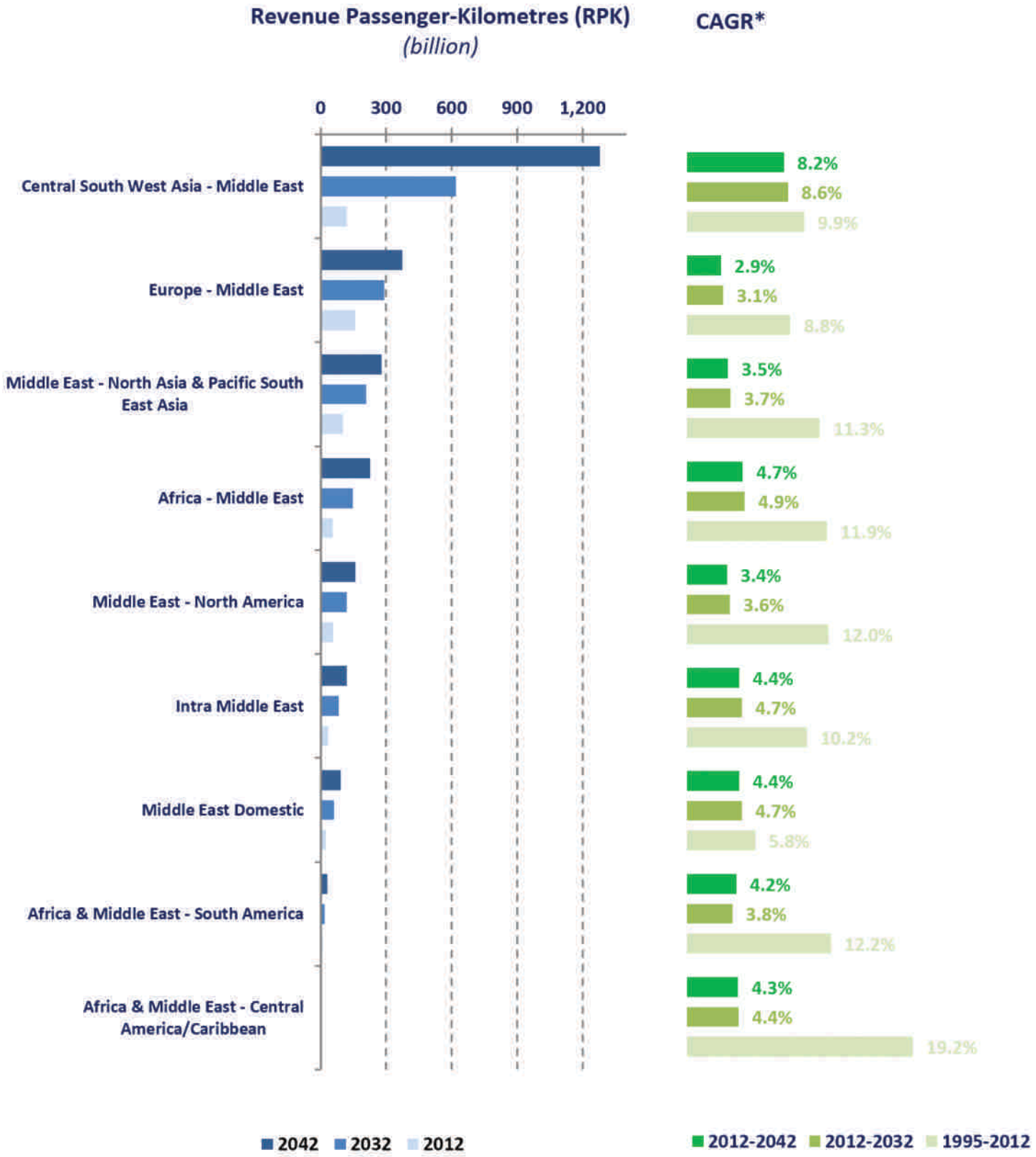
*CAGR: Compound Annual Growth Rate

Latin America and the Caribbean

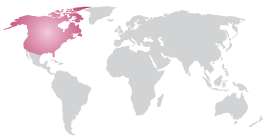


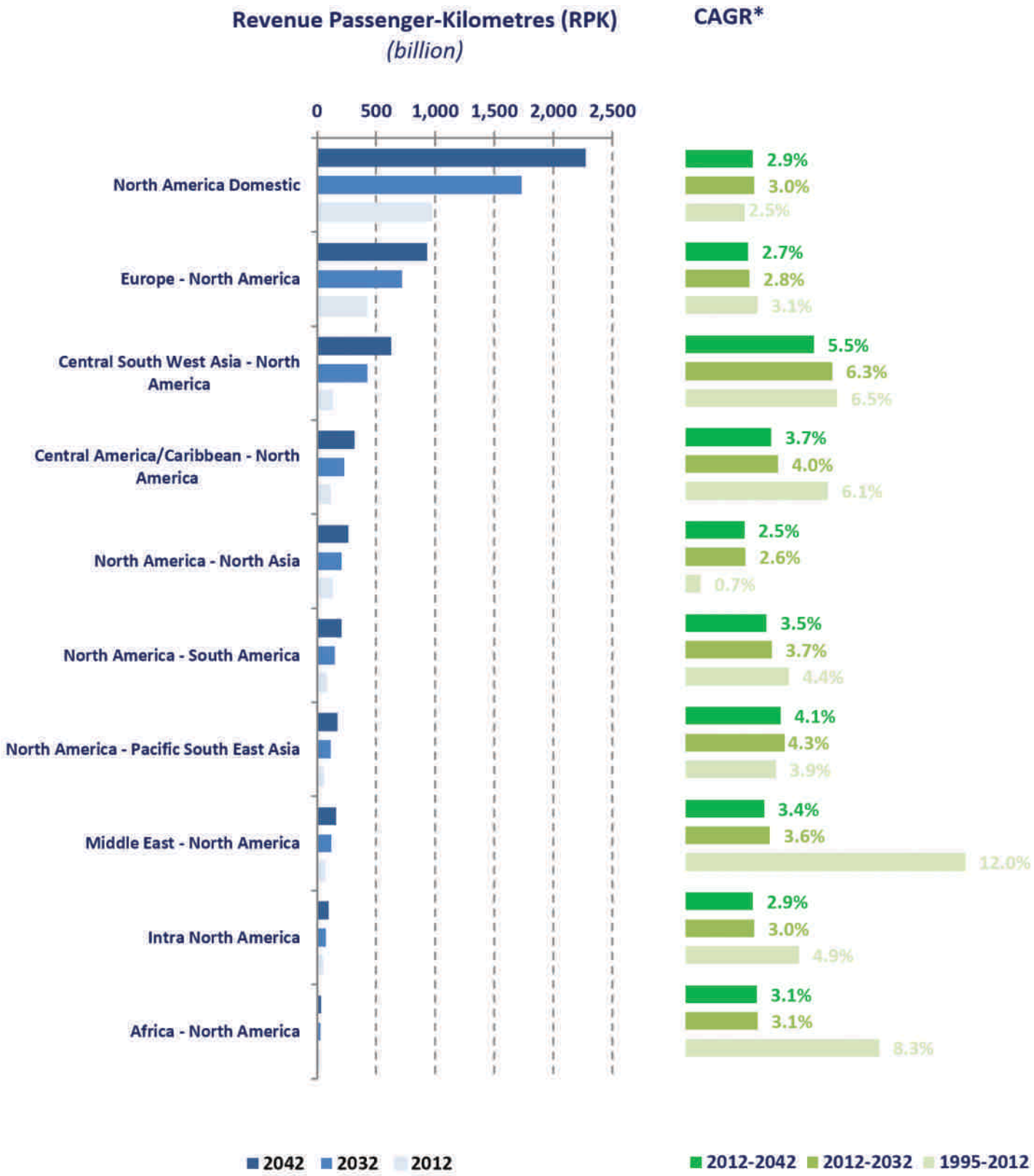
*CAGR: Compound Annual Growth Rate

Middle East



*CAGR: Compound Annual Growth Rate





*CAGR: Compound Annual Growth Rate

Definition of Regions

AFRICA

North Africa

Algeria
Egypt
Libya
Morocco
Tunisia

Sub Saharan Africa

Benin
Botswana
Burkina Faso
Burundi
Cabo Verde
Cameroon
Central African Republic
Chad
Comoros
Congo
Côte d'Ivoire
Democratic Republic of the Congo
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
South Sudan
Sudan
Swaziland
Togo
Uganda
United Republic of Tanzania
Zambia
Zimbabwe

ASIA AND PACIFIC

Central and South-West Asia

Afghanistan
Bangladesh
Bhutan
China
India
Kazakhstan
Kyrgyzstan
Mongolia
Myanmar
Nepal
Pakistan
Sri Lanka
Tajikistan
Turkmenistan
Uzbekistan

North Asia

Democratic People's Republic of Korea
Japan
Republic of Korea

Pacific South-East Asia

Australia
Brunei Darussalam
Cambodia
Cook Islands
Fiji
Indonesia
Kiribati
Lao People's Democratic Republic
Malaysia
Maldives
Marshall Islands
Nauru
New Zealand
Palau
Papua New Guinea
Philippines
Samoa
Singapore
Solomon Islands
Thailand
Tonga
Vanuatu
Viet Nam
Micronesia (Federated States of)
Timor-Leste

EUROPE

Albania
Andorra
Armenia
Austria
Azerbaijan
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Georgia
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Monaco
Montenegro
Netherlands
Norway
Poland
Portugal
Republic of Moldova
Romania
Russian Federation
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
The former Yugoslav Republic of Macedonia
Turkey
Ukraine
United Kingdom

LATIN AMERICA AND THE CARIBBEAN

Central America/ Caribbean

Antigua and Barbuda
Bahamas
Barbados
Belize
Costa Rica
Cuba
Dominican Republic
El Salvador
Grenada
Guatemala
Haiti
Honduras
Jamaica
Mexico
Nicaragua
Panama
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Trinidad and Tobago

South America

Argentina
Bolivia (Plurinational State of)
Brazil
Chile
Colombia
Ecuador
Guyana
Paraguay
Peru
Suriname
Uruguay
Venezuela (Bolivarian Republic of)

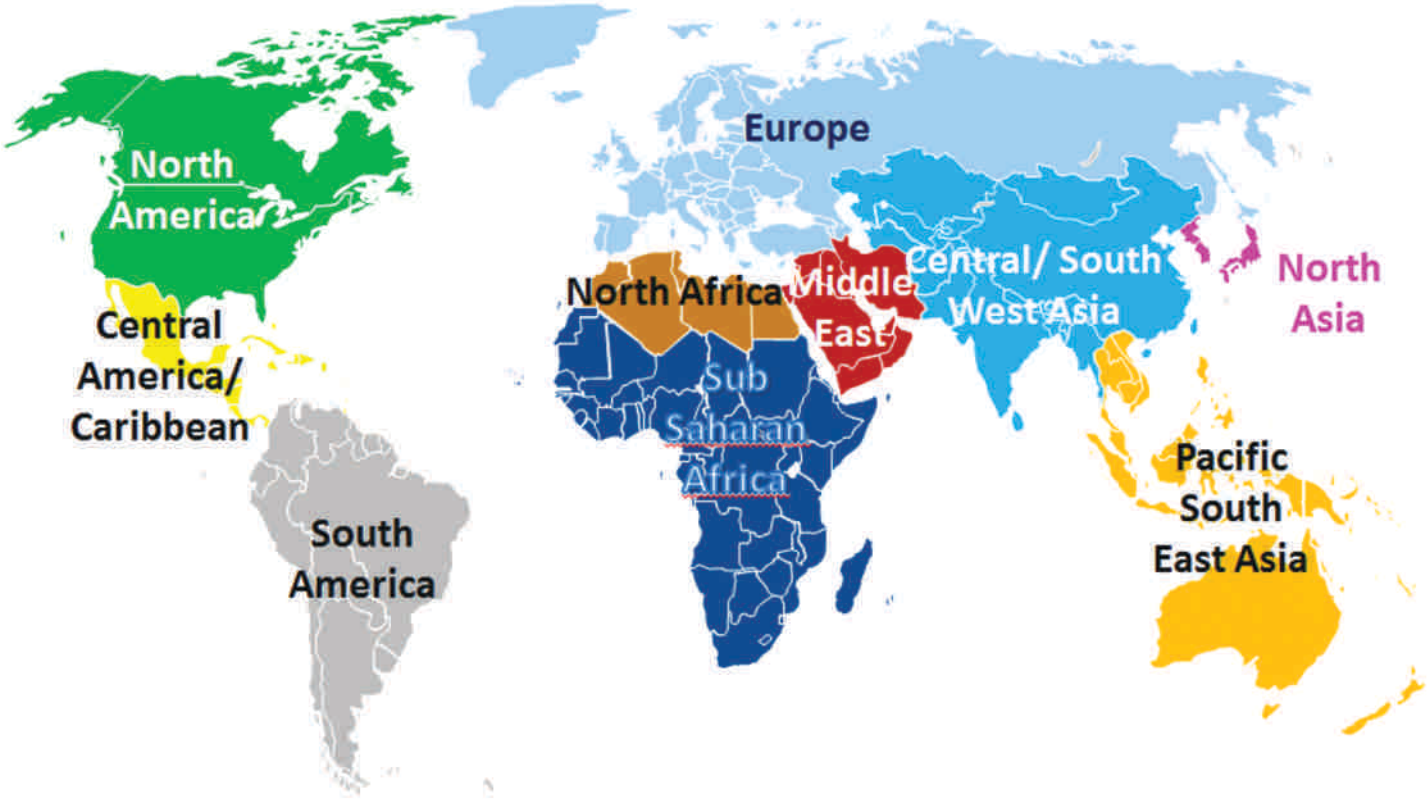
MIDDLE EAST

Bahrain
Iran (Islamic Republic of)
Iraq
Israel
Jordan
Kuwait
Lebanon
Oman
Qatar
Saudi Arabia
Syrian Arab Republic
United Arab Emirates
Yemen

NORTH AMERICA

Canada
United States

World map of Long Term Forecasts Regions



Summary of Passenger Traffic Forecasts by Route Group

Passenger traffic results in terms of RPKs

Region / Region-pair	CAGR* 10 Year (2012-2022)	20 Year (2012-2032)	30 Year (2012-2042)
Africa Domestic	4.6%	4.5%	4.3%
Africa & Middle East - Central America/Caribbean	4.5%	4.4%	4.3%
Africa & Middle East - South America	3.1%	3.8%	4.2%
Africa - Asia/Pacific	6.6%	6.1%	5.8%
Africa - Middle East	4.5%	4.9%	4.7%
Africa - North America	3.3%	3.1%	3.1%
Central America/Caribbean Domestic	4.0%	4.2%	4.2%
Central America/Caribbean - Europe	3.1%	3.2%	2.9%
Central America/Caribbean - North America	4.2%	4.0%	3.7%
Central America/Caribbean - South America	2.8%	3.8%	4.0%
Central South West Asia - North Asia	9.1%	8.4%	7.7%
Central South West Asia - Pacific South East Asia	8.9%	7.9%	7.4%
Central South West Asia Domestic	10.3%	8.8%	7.6%
Central South West Asia - Europe	5.5%	5.2%	4.7%
Central South West Asia - Middle East	8.2%	8.6%	8.2%
Central South West Asia - North America	7.3%	6.3%	5.5%
Europe Domestic	2.5%	2.5%	2.5%
Europe - Middle East	3.4%	3.1%	2.9%
Europe - North Africa	3.2%	3.3%	3.3%
Europe - North America	2.9%	2.8%	2.7%
Europe - North Asia	2.3%	2.3%	2.2%
Europe - Pacific South East Asia	3.6%	3.8%	3.6%
Europe - South America	2.8%	3.0%	2.9%
Europe - Sub Saharan Africa	2.0%	2.1%	2.0%
Intra Africa	4.5%	4.5%	4.3%
Intra Central America/Caribbean	4.1%	4.2%	4.2%
Intra Central & South West Asia	10.0%	8.7%	7.7%
Intra Europe	2.5%	2.5%	2.5%
Intra Middle East	4.7%	4.7%	4.4%
Intra North America	3.3%	3.0%	2.9%
Intra North Asia	1.7%	1.6%	1.4%
Intra Pacific South East Asia	5.4%	5.3%	5.1%
Intra South America	2.2%	3.2%	3.5%
Latin America/Caribbean - Central Southwest Asia	8.0%	7.7%	6.7%
Latin America/Caribbean - North Asia & Pacific South East Asia	2.6%	2.9%	2.7%
Middle East Domestic	4.7%	4.7%	4.4%
Middle East - North America	4.4%	3.6%	3.4%
Middle East - North Asia & Pacific South East Asia	4.1%	3.7%	3.5%
North America Domestic	3.3%	3.0%	2.9%
North America - North Asia	2.8%	2.6%	2.5%
North America - Pacific South East Asia	4.4%	4.3%	4.1%
North America - South America	3.8%	3.7%	3.5%
North Asia Domestic	1.7%	1.6%	1.4%
North Asia - Pacific South East Asia	3.7%	3.8%	3.6%
Pacific South East Asia Domestic	5.4%	5.3%	5.1%
South America Domestic	2.2%	3.2%	3.5%
World Total	**4.7%**	**4.6%**	**4.5%**

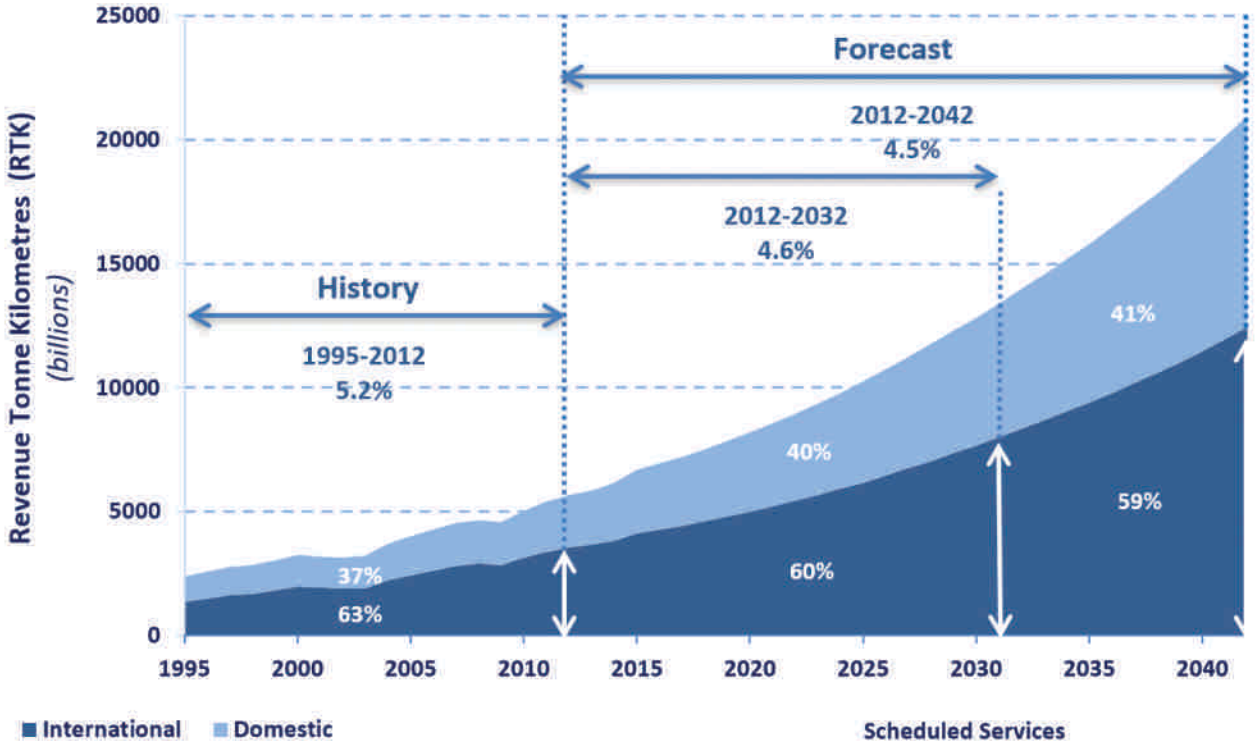
*CAGR: Compound Annual Growth Rate

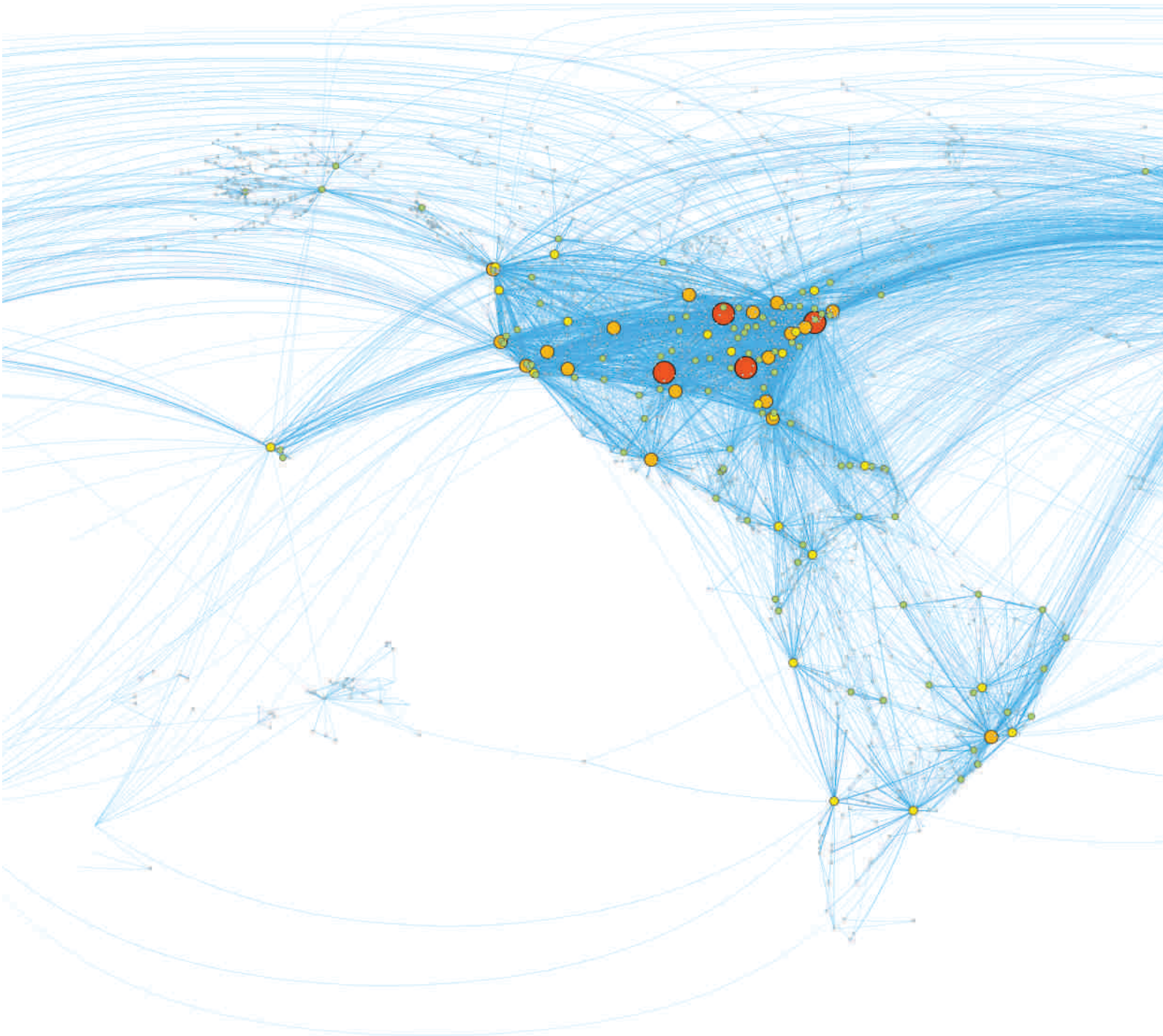
Summary of Total Cargo Traffic Forecasts by Region of Airline Registration

(Scheduled Services)
Cargo traffic results in terms of FTKs

Region / Region-pair		CAGR* 10 Year (2012-2022)	CAGR* 20 Year (2012-2032)	CAGR* 30 Year (2012-2042)
Europe	**Total**	**2.9%**	**2.6%**	**2.4%**
	International	2.9%	2.6%	2.4%
	Domestic	0.2%	0.8%	1.0%
Africa	**Total**	**1.6%**	**2.1%**	**2.2%**
	International	1.6%	2.1%	2.2%
	Domestic	0.3%	0.1%	0.1%
Middle East	**Total**	**6.6%**	**7.1%**	**6.9%**
	International	6.6%	7.1%	6.9%
	Domestic	1.4%	0.7%	0.5%
Asia and Pacific	**Total**	**5.7%**	**5.1%**	**4.7%**
	International	5.2%	4.7%	4.3%
	Domestic	8.7%	7.8%	7.0%
North America	**Total**	**2.7%**	**2.5%**	**2.6%**
	International	3.7%	3.5%	3.4%
	Domestic	0.8%	0.7%	0.6%
Latin America and the Caribbean	**Total**	**3.1%**	**2.9%**	**2.8%**
	International	3.4%	3.1%	3.0%
	Domestic	2.0%	1.7%	1.6%
WORLD	**Total scheduled**	**4.4%**	**4.3%**	**4.2%**
	International	4.5%	4.4%	4.2%
	Domestic	3.9%	4.0%	4.0%

Total traffic: history and forecasts



CHI
NYC
DFW
ATL
Legend
CITIES Departures per year
1 - 14999
15000 - 58829
58830 - 140764
140765 - 303197
303198 - 592762
FLOW movements per year
FLOW2101-47072
FLOW1001-2100
FLOW401-1000
FLOW166-400
FLOW1-165

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