



**WORKING PAPER**

**ASSEMBLY — 41ST SESSION**

**EXECUTIVE COMMITTEE**

**Agenda Item 13: Facilitation Programmes**

**DEVELOPMENTS PERTAINING TO THE ICAO PUBLIC KEY DIRECTORY (PKD)**

(Presented by the Council of ICAO)

**EXECUTIVE SUMMARY**

The ICAO Public Key Directory (PKD) is an integral component of international infrastructure supporting use of electronic Machine Readable Travel Documents (eMRTDs), facilitating the sharing of public key certificates necessary as part of the global eMRTD ecosystem. Since the 40th Session of the Assembly, the PKD system has evolved with new participants continuing to join, more data being included and new services being added. Future support for authenticating health proofs for travel is being considered while possible future use by private sector entities is also being explored.

**Action:** The Assembly is invited to:

- a) approve the priorities and work programme for the ICAO PKD for the next triennium, as outlined in Section 5, taking note that the development and management of the PKD is one of the priorities in the ICAO Business Plan 2023–2025;
- b) urge all ICAO Member States to join the ICAO PKD; and
- c) request all States participating in the ICAO PKD to upload all appropriate information to the system and to make full use of the services offered.

<i>Strategic Objectives:</i>	This working paper relates to the Strategic Objective — <i>Security and Facilitation</i> .
<i>Financial implications:</i>	The ICAO PKD work programme is funded by participant fees. Specific PKD-related activities referenced in this paper should be funded directly through the PKD fund. Additional considerations introduced related to generic infrastructural or capability development would require availability of additional budget under the Regular Budget or voluntary contributions.
<i>References:</i>	Doc 10140, <i>Assembly Resolutions in Force</i> (as of 4 October 2019) Annex 9 — <i>Facilitation, 15th Edition</i> Memorandum of Understanding (MoU) regarding participation and cost-sharing in the electronic machine readable travel documents ICAO Public Key Directory (PKD) Doc 9303, <i>Machine Readable Travel Documents, 8th Edition</i> A40-WP/6, <i>Developments pertaining to the ICAO Public Key Directory (PKD)</i> A40-WP/8, <i>Developments pertaining to the ICAO Traveller Identification Programme (TRIP) Strategy</i> A41-WP/10, <i>Developments pertaining to the ICAO Traveller Identification (ICAO TRIP) Strategy</i>

## 1. BACKGROUND

1.1 Electronic machine readable travel documents (eMRTDs) encode identity information relevant to one's travel in digital format, enhancing travel security and facilitation. ICAO issues specifications for a variety of eMRTD formats, including the ePassport, the Digital Travel Credential (DTC) and the Visible Digital Seal (VDS) (c.f. A41-WP/10 (*Developments pertaining to the ICAO Traveller Identification Programme (ICAO TRIP) Strategy*)). All formats prescribe the application of a digital signature to the stored data, providing for assurance of document authenticity and data integrity when the signature is properly verified. The verification of the signature relies upon the availability of the appropriate public keys.

1.2 Bilateral exchange of these keys, typically shared as public key certificates, becomes extremely challenging as more countries issue eMRTDs and as requirements for their regular and timely exchange become more stringent. Centralized sharing through a nexus for State authorities involved in eMRTD issuance and verification greatly facilitates multilateral exchange. On this basis, ICAO established the Public Key Directory (PKD) in 2007 in order to share public key certificates between States.

1.3 The PKD has become an increasingly important component of global eMRTD infrastructure over the past years as more States have begun issuing ePassports (more than 145 States are now issuing ePassports), eVisas (the European Union has mandated issuance of eVisas using the VDS format in 2022) and health proofs based on the ICAO VDS-NC specifications and as States begin to consider dematerialization of the passport booklet through issuance of the DTC. This has resulted in the evolution of the PKD and its related framework in the period since the 40th Session of the ICAO Assembly, as described in Sections 2 and 3 of this paper, as well as substantial outreach to assure recognition of the system's value, as described in Section 4. The rapidly-evolving landscape also demands consideration of how the PKD system can maintain agility and continue to deliver maximum value moving forward while building on recent developments. Priorities for development are outlined in Section 5.

## 2. THE REGULATORY FRAMEWORK AND PARTICIPATION STATUS

2.1 Standard 3.9.2 was added to Annex 9 — *Facilitation* to the *Convention on International Civil Aviation* as part of Amendment 28 to the Annex which became effective on 28 February 2021 as the first Standard pertaining to the ICAO PKD (SL 2020/71 refers). It requires States that participate in the ICAO PKD to upload all public key data necessary for authentication of all electronic passports that they issue to the PKD. It complements the existing Recommended Practices that those issuing eMRTDs and checking eMRTDs at their borders should join the PKD.

2.2 The PKD is funded solely through the financial contributions of the participants who share costs evenly between them. Thus, annual fees decrease as the number of PKD participants increases. In 2022, participants paid USD 7,096.25 to cover ICAO's costs and USD 18,000.00 as their share of the payment due to the private sector operator of the ICAO PKD, totalling USD 25,096.25 (compared to USD 29,853.23 in 2019). The decreasing fees since 2015 are shown in Appendix A. An amendment to the existing contract with the operator was made in March 2021, extending the contract for an additional five years and thereby guaranteeing that this fee structure will apply for delivery of existing services until 2026.

2.3 More States began to participate in the PKD in the period 2019–2021 than in any previous 3-year period, testament to the on-going value of the system. In the course of 2019, 8 Member States (Belarus, Bosnia and Herzegovina, Croatia, Egypt, Indonesia, Italy, Uganda and the United Republic of

Tanzania) joined the PKD; in 2020, 4 Member States (Bangladesh, Ecuador, Rwanda and Togo) joined; and in 2021, 7 Member States (Ghana, Lesotho, Mexico, Mongolia, Nepal, Sudan and Viet Nam) joined, bringing the total number of PKD participants to 82. A complete list of participants is provided in Appendix B.

### **3. DEVELOPMENT OF NEW SERVICES**

3.1 The first ICAO Master List was issued in March 2020 through the ICAO PKD. This list makes available the root of trust (“CSCA”) public key certificates of eMRTD issuing States, providing a trustworthy source of the most essential public keys needed for eMRTD authentication. It is signed under the UN Laissez Passer ePassport root of trust, allowing recipients to validate its authenticity and integrity. Entities whose certificates are included in the Master List as of December 2021 are listed in Appendix C.

3.2 A pilot program in which private sector entities engaged in the travel continuum are authorized to use data obtained from the PKD in their operations was launched in December 2021. Its launch reflects an increasing involvement of such entities in public-private partnerships within the travel continuum and the associated importance of them being equipped to properly verify eMRTDs. It also encourages private sector parties to provide immediate solutions to States to address unanticipated challenges arising in times of flux. Authorization for PKD data use has been provided to 15 companies. After the 6-month pilot program, information attained will inform next steps.

3.3 In order to support the dissemination of public key material necessary for authentication of health proofs (in conformance with the Council Aviation Recovery Task Force (CART) recommendations and guidance from the World Health Organization (WHO)), and given that the WHO guidance indicates that health proofs should be issued based on Public Key Infrastructure that leverages existing capabilities like the ICAO PKD, the PKD Board has examined the implementation of a new health branch in the PKD. While this work proceeds, a new ICAO Health Master List has been established based on a novel service delivery model involving partnership with INCERT, the Luxembourg State Agency responsible for critical IT infrastructure, allowing for rapid rollout of the new solution at no cost to ICAO or to Member States.

### **4. OUTREACH AND ENHANCED ASSISTANCE**

4.1 Developments in the PKD were highlighted to the Council in informal briefings held on 11 May 2020 (on the new ICAO Master List) and on 26 January 2022 (on the private sector use pilot project). The ICAO Master List was introduced by the Chair of the PKD Board at the 16th ICAO TRIP Symposium (25-27 May 2021) while ICAO hosted PKD workshops and/or delivered presentations at a variety of international virtual events. Several presentations have been delivered at meetings of the ICAO New Technologies Working Group of the TAG/TRIP in order to assure continued alignment between specification development and PKD operational implementation.

4.2 State letter EC 6/8.3–20/68, *The new ICAO Master List (ML) of the ICAO Public Key Directory (PKD)*, issued on 19 June 2020, informed Member States of the new ICAO Master List.

4.3 The PKD Board approved a new PKD capacity-building initiative — the PKD “Data Quality Coach” program in November 2020 (Appendix D). The program pairs PKD participants with experienced coaches who will support their efforts to connect to and properly use the PKD in the context of their wider eMRTD implementation activities. The Board selected Mongolia as the first recipient of the coaching program and the coaching efforts began in December 2021.

## 5. PRIORITIES FOR THE 2023 – 2025 TRIENNIUM

5.1 eMRTDs are a fundamental component of innovation in air transport facilitation, supporting technology and process innovation related to seamless and contactless travel procedures. The full authentication of electronic documents is critical in this regard. The PKD must therefore be a cornerstone of work under the Strategic Objective Security and Facilitation in the ICAO Business Plan for the 2023–2025 triennium. This requires its full use by all States issuing or receiving eMRTDs.

5.2 The COVID-19 pandemic highlighted that existing capabilities must be in place to ensure readiness for unexpected challenges, while these capabilities must themselves be adaptable.

5.3 The Assembly is therefore invited to support the ICAO PKD according to the following priorities for the next triennium:

- a) assurance of uninterrupted PKD operations and maintenance of the integrity of the system;
- b) expansion of the activities of the PKD to exchange additional certificates;
- c) empowering of private sector parties to use PKD data to benefit States and aviation stakeholders;
- d) improving use of the PKD and compliance with ICAO eMRTD standards and specifications through the Data Quality Coach program, outreach activities and cooperation with the TAG/TRIP and its subgroups; and
- e) assuring readiness for renewal of the existing PKD operational contract to ensure continued operation and cost-effective evolution of the system moving forward.

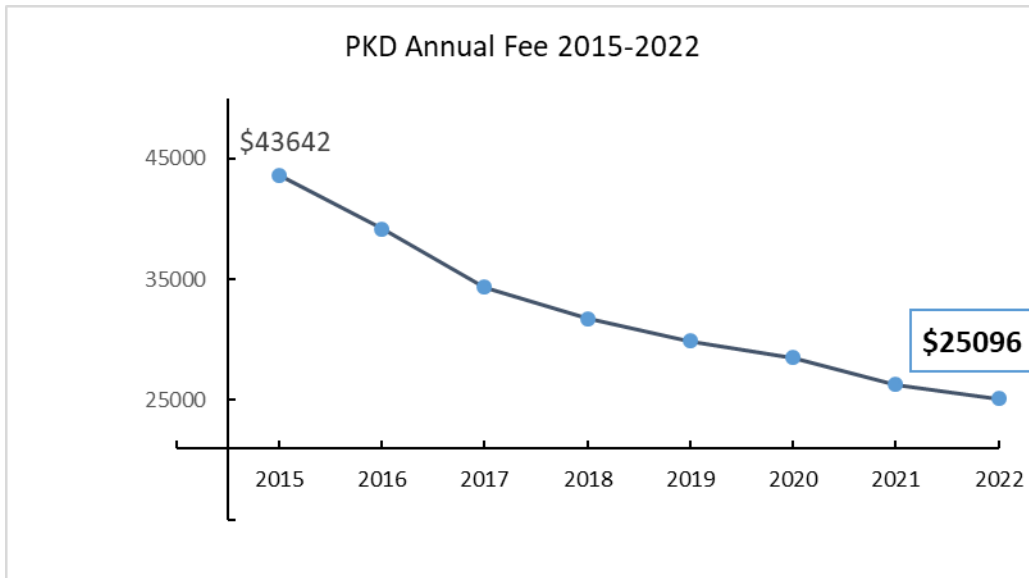
5.4 The Assembly is also invited to endorse the following as priorities, pending the conclusion of financial viability based on current financial models or attainment of additional resources:

- a) implementation of a new health branch in the ICAO PKD to support dissemination of public key material associated with PKI-based health proofs and thereby better assure global interoperability; and
- b) enhancement of the implementation capabilities to adapt or improve services in response to external challenges and demands, in particular through use of in-house development resources.

5.5 As per the pertinent KPI in the Business Plan 2023–2025, the Assembly is invited to urge all Member States to join the PKD and to request Member States participating in the PKD to upload all information necessary for full authentication of their eMRTDs into the ICAO PKD, in line with ICAO Annex 9 Standard 3.9.2, and to make full use of the data contained therein, given the importance of full use to allow for contactless processing of passengers, increased technology and process innovation in facilitation and increased robustness to future challenges.

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**APPENDIX A**



*The decrease in annual fees for PKD participants in the period from 2015 to 2022*

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**APPENDIX B**  
**LIST OF ICAO PKD PARTICIPATING STATES AND ENTITIES**

PKD Participant Number	PKD Participating States and Entities	Joining Date		PKD Participant Number	PKD Participating States and Entities	Joining Date
1	Australia (PKD Board Member)	19/03/2007		42	Seychelles	14/03/2014
2	New Zealand (PKD Board Member)	19/03/2007		43	Uzbekistan	19/03/2014
3	Singapore (PKD Board Member)	19/03/2007		44	Philippines	21/03/2014
4	United Kingdom (PKD Board Member)	19/03/2007		45	Iran (Islamic Republic of)	18/05/2014
5	Japan (PKD Board Member)	19/03/2007		46	Colombia	19/05/2015
6	Canada (PKD Board Member)	19/03/2007		47	Romania	03/02/2016
7	United States of America (PKD Board Member)	02/11/2007		48	Finland	26/02/2016
8	Germany	01/11/2007		49	Benin	03/03/2016
9	Republic of Korea	28/03/2008		50	Botswana	05/04/2016
10	France (PKD Board Member)	19/06/2008		51	Kuwait	20/04/2016
11	People's Republic of China (PKD Board Member)	26/11/2008		52	Georgia	25/05/2016
12	Republic of Kazakhstan	19/12/2008		53	Türkiye	30/09/2016
13	India	12/02/2009		54	Iceland	30/09/2016
14	Nigeria (PKD Board Member)	13/04/2009		55	Oman	22/12/2016
15	Switzerland (PKD Board Member)	10/07/2009		56	Turkmenistan	13/02/2017
16	Ukraine	30/10/2009		57	Peru	28/02/2017
17	Latvia	28/06/2010		58	Barbados	29/03/2017
18	Czechia	30/06/2010		59	Panama	19/10/2017
19	Macao SAR, China	28/09/2010		60	European Union	07/11/2017
20	United Arab Emirates	25/10/2010		61	Mali	28/06/2018
21	Hong Kong SAR, China	26/10/2010		62	Côte d'Ivoire	19/07/2018
22	Slovakia	23/11/2010		63	Serbia	28/12/2018
23	The Netherlands (PKD Board Member)	08/12/2010		64	Italy	26/03/2019
24	Kingdom of Morocco (PKD Board Member)	29/12/2010		65	Croatia	01/04/2019
25	Austria	31/12/2010		66	Uganda	12/06/2019

26	<b>Hungary</b>	15/02/2011		67	<b>Bosnia &amp; Herzegovina</b>	08/07/2019
27	<b>Norway</b>	20/06/2011		68	<b>Egypt</b>	09/08/2019
28	<b>Bulgaria</b>	12/10/2011		69	<b>Indonesia</b>	30/08/2019
29	<b>Luxembourg</b> (Chairperson of PKD Board)	30/11/2011		70	<b>Belarus</b>	01/10/2019
30	<b>Sweden</b>	01/12/2011		71	<b>United Republic of Tanzania</b>	20/11/2019
31	<b>United Nations</b>	14/06/2012		72	<b>Bangladesh</b>	29/06/2020
32	<b>Spain</b> (PKD Board Member)	10/07/2012		73	<b>Togo</b>	02/07/2020
33	<b>Russian Federation</b>	31/08/2012		74	<b>Ecuador</b>	17/07/2020
34	<b>Malaysia</b>	09/11/2012		75	<b>Rwanda</b>	23/07/2020
35	<b>Argentina</b>	13/12/2012		76	<b>Sudan</b>	12/01/2021
36	<b>Thailand</b>	05/03/2013		77	<b>Lesotho</b>	21/04/2021
37	<b>Ireland</b>	08/03/2013		78	<b>Mexico</b>	14/06/2021
38	<b>Republic of Moldova</b>	11/06/2013		79	<b>Ghana</b>	13/10/2021
39	<b>Belgium</b>	31/10/2013		80	<b>Nepal</b>	18/10/2021
40	<b>Brazil</b>	03/01/2014		81	<b>Viet Nam</b>	17/12/2021
41	<b>Qatar</b>	10/03/2014		82	<b>Mongolia</b>	29/12/2021

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**APPENDIX C**  
**LIST OF eMRTD ISSUING ENTITIES WITH CERTIFICATES IN THE ICAO MASTER LIST**  
**(FEBRUARY 2022)**

Argentina	Hungary	Republic of Kazakhstan
Australia	Iceland	Republic of Korea
Austria	India	Republic of Moldova
Barbados	Indonesia	Romania
Belarus	Iran, Islamic Republic of	Russian Federation
Belgium	Ireland	Rwanda
Benin	Italy	Singapore
Botswana	Japan	Slovakia
Brazil	Kingdom of Morocco	Spain
Bulgaria	Kuwait	Sweden
Canada	Latvia	Switzerland
China	Luxembourg	Thailand
Hong Kong SAR, China	Malaysia	Türkiye
Macao SAR, China	Mexico	Turkmenistan
Colombia	Netherlands	Ukraine
Côte d'Ivoire	New Zealand	Uganda
Czechia	Nigeria	United Arab Emirates
Ecuador	Norway	United Kingdom
European Union	Oman	United Nations
Finland	Panama	United Republic of Tanzania
France	Peru	United States of America
Germany	Philippines	Uzbekistan
Ghana	Qatar	

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## **APPENDIX D**

### **The ICAO PKD Data Quality Coach Initiative**

During the 26<sup>th</sup> meeting of the PKD Board, a proposal was made regarding the appointment of volunteer data quality (DQ) coaches who could be paired with different new PKD members or those struggling to come up to speed with PKD usage in order to provide the necessary help. The initiative was foreseen as a means of boosting the quality of data in the PKD (in terms of completeness as well as usability) and encouraging new participants. Subsequent to the meeting, the Vice-Chairperson of the Board collaborated with the Secretariat to refine the concept and elaborate procedural rules related to the program. A proposal outlining the concept and the approach to implementation was put to the Board and approved at the 27<sup>th</sup> meeting, with an immediate mandate given to the Secretariat to launch the program through collection of the names of coaches from PKD Board members and dissemination of a request to States (both PKD participants and those who had expressed an intention to join) to ascertain their interest in participating).

Data quality coaches are Member State experts with deep knowledge of PKI. They are fluent in English and normally able to communicate in another language of potential use in outreach to States (e.g. French, Spanish, Russian, Arabic). Eight coaches were nominated by national PKD Board members following an open call from the Secretariat and all were approved by the Board for the period of 2020/2021. Renewed calls will be launched on an annual basis.

States who express their interest in participating provide an outline of their reasoning and their requirements using an online form. The Board assesses the candidatures on an annual basis based on established criteria – their location in a region of priority as identified in the PKD Strategy, the possible availability of other support resources for that State (e.g. from the OSCE), the eagerness on the part of the identified States to engage in the initiative and the suitability of DQ coaches available. Currently, it is anticipated that one or two States will receive coaching each year. In 2021, the Board selected Mongolia and Cameroon as candidates for coaching. Mongolia have recently initiated the coaching program subject for a period of 12 months from December 2021.

In the first months of each partnership, remote contact between the State, the DQ coach and the ICAO secretariat will be established. Any issues with national organizational arrangements might also be identified and remedied at this stage. In later months, each State should host a dedicated 3 to 4 day visit by the coach, should such an effort be deemed appropriate by the coach. Where feasible, he/she may be supported by members of the ICAO secretariat and/or DQ coaching team in order to provide continuity of experience across different visits. The visit will be followed by all further outreach necessary to ensure continuity of effective operations going forward. The outreach should normally be fully concluded in a single calendar year.

It is emphasized that the appointed DQ coaches are intended to support the receiving State in their efforts to appropriately make use of their PKD participation. The coach is not intended to execute work on behalf of the State. It is incumbent on the receiving State to have the appropriate organizational setup and capacities necessary to execute the work intended. Indeed, the initial outreach in the early part of the year is intended to assure the availability of the necessary resources at national level. In case that the receiving State cannot be in a position to execute the necessary work identified by the DQ coach, work with that State in the defined year will cease. The Secretariat and DQ coaching team will provide a dedicated report to the PKD Board each year.

The activities are fully funded through the PKD “Reserve Fund” (i.e. Development and Implementation Fund). The main costs foreseen are the travel costs and daily allowances of the DQ coach and any Secretariat/DQ coaching team attending the country visits.