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Agenda Item 4: Emerging technologies, new business models and other associated aspects
4.3: Leveraging air transport data and the digital ecosystem for seamless, secure and resilient operations

INDIA'S PLANNED PROOF OF CONCEPT FOR DIGI YATRA IN INTERNATIONAL TRAVEL: IMPLEMENTING INTEROPERABLE ICAO DIGITAL TRAVEL CREDENTIALS (DTC) FOR SEAMLESS CROSS-BORDER FACILITATION

(Presented by India)

EXECUTIVE SUMMARY

This working paper presents India's strategic roadmap and operational framework for expanding its national biometric facilitation ecosystem, Digi Yatra, to international air travel. Building upon a proven domestic deployment across 39 major airports processing over 30 million passengers with check-in and security processing times under ten seconds, India is initiating a live Proof of Concept (POC) for outbound international departures across five major international airports. The international POC incorporates International Civil Aviation Organization (ICAO) -compliant Digital Travel Credentials (DTC) (Type 1 virtual component and DTC Type 2 physical link) derived directly from chip -enabled e-Passports via Near Field Communication (NFC) technology. Grounded in a self-sovereign identity (SSI) and Privacy-by-Design (PbD) architecture, passenger credentials remain encrypted on personal mobile wallets and are purged automatically 24 hours post-departure. The paper details the inter-agency governance model coordinating civil aviation facilitation with statutory immigration control under the Ministry of Home Affairs, outlines cross-border Public Key Infrastructure (PKI) trust requirements, and proposes specific actionable recommendations for ICAO to accelerate global digital identity interoperability.

1. INTRODUCTION

1.1 Global air transport is experiencing unprecedented passenger volume recovery and growth, placing significant operational strain on physical terminal infrastructure, security checkpoints, and border control facilities worldwide. Traditional airport expansion models —relying on capital-intensive civil construction—are increasingly constrained by financial, spatial, and environmental limitations. In response, the International Civil Aviation Organization (ICAO) Traveller Identification Programme (TRIP) Strategy

advocates for a holistic digital approach that links secure travel document issuance, robust biometric identification, and automated border clearance to enhance both security and passenger facilitation.

1.2 As part of its commitment to technological innovation and seamless passenger mobility, India launched the Digi Yatra initiative under the Ministry of Civil Aviation (MoCA) and the non-profit Digi Yatra Foundation. Designed as a decentralized, paperless, and contactless passenger processing system, Digi Yatra uses Facial Recognition Technology (FRT) as a single biometric token to navigate travelers through airport entry, security hold areas, and boarding gates without physical document inspection.

1.3 Having successfully demonstrated the operational efficiency, privacy compliance, and public acceptance of Digi Yatra across India's domestic aviation network, India is now advancing to the next operational frontier: extending biometric passenger facilitation to outbound international travel. This working paper provides the Seventh Worldwide Air Transport Conference (ATConf/7) with an authoritative overview of India's international Proof of Concept (POC), detailing its technological alignment with ICAO Digital Travel Credential (DTC) specifications, its inter-agency governance framework, and its policy contributions to global air transport.

2. DOMESTIC DIGI YATRA MILESTONE AND OPERATIONAL LESSONS

2.1 Launched in December 2022, Digi Yatra has scaled rapidly across India's airport network. As of late 2026, the platform is fully operational across 39 domestic airports, with infrastructure rollouts under way to reach 64 airports by early 2027. To date, the system has processed over 30 million passenger departures, achieving an average adoption rate of approximately 30% among departing domestic travellers at major hub airports such as Delhi, Mumbai, Bengaluru, and Hyderabad.

2.2 Key Performance Indicators (KPIs) from domestic operations demonstrate transformative facilitation gains:

a) **Processing Velocity**: Automated e-Gates reduce passenger validation time at terminal entry and pre-security checkpoints from 35-45 seconds per passenger to under 10 seconds.

b) **Queue Abatement**: Peak-hour throughput at terminal entry gates increased by over 300%, effectively eliminating curbside congestion during peak departure banks.

c) **Operational Efficiency**: Aviation security personnel,Central Industrial Security Force (CISF) experienced reduced manual document verification burdens, allowing resource reallocation toward high -risk threat monitoring.

d) **Passenger Satisfaction**: Opt-in adoption rates continue to climb, driven by a 100% contactless experience that eliminates paper boarding pass handling.

2.3 A cornerstone of domestic success is Digi Yatra's strict Privacy-by-Design (PbD) and Self-Sovereign Identity (SSI) architecture. Unlike centralized biometric databases, Digi Yatra operates on a decentralized mobile wallet model. Personally Identifiable Information (PII) and facial biometric templates are stored exclusively on the passenger's smartphone. During travel, encrypted Verifiable Credentials (VCs) are shared directly with the airport e-Gate on a consent-only basis for day-of-travel processing. Crucially, all airport biometric data is automatically purged from local airport servers within 24 hours post-flight departure, ensuring compliance with strict data protection mandates.

Table 1: Operational Comparison — Domestic vs. International Digi Yatra Frameworks

Operational Dimension	Domestic Digi Yatra	International Digi Yatra (POC)
Identity Document Basis	Aadhaar / DigiLocker / Government ID	ICAO-Compliant e-Passport (ICAO Doc 9303)
Enrollment Channel	Digi Yatra App via Aadhaar OTP & Selfie	NFC Chip Scan of e-Passport + Live Selfie
Credential Standard	W3C Verifiable Credential (Domestic Format)	ICAO Digital Travel Credential (DTC-1 & DTC-2)
Statutory Touchpoints	Terminal Entry, Pre-Security, Boarding	Terminal Entry, Security, Immigration e-Gates, Boarding

3. ARCHITECTURE OF THE DIGI YATRA INTERNATIONAL PROOF OF CONCEPT

3.1 To extend biometric facilitation to cross-border journeys, the Ministry of Civil Aviation and the Digi Yatra Foundation have launched a phased live trial across five major international gateway airports (Delhi, Mumbai, Bengaluru, Hyderabad, and Pune) focusing on outbound international departing passengers. The initiative bridges civil aviation passenger processing with statutory border control mandates governed by the Ministry of Home Affairs (Bureau of Immigration).

3.2 **Technological Architecture and ICAO DTC Alignment**: International Digi Yatra shifts identity verification from domestic registration mechanisms to ICAO Doc 9303 - *Machine Readable Travel Documents* compliant e-Passports. The technical workflow operates through four seamless stages:

a) **Near Field Communication (NFC) e-Passport Chip Extraction**: Passengers open the Digi Yatra application on an NFC-enabled smartphone and tap their physical e-Passport. The mobile application reads the contactless microprocessor chip embedded in the passport cover, extracting the digital facial image, demographic data, and Security Object Document (SOD).

b) **Cryptographic Authentication & DTC Generation**: The application verifies the digital signature of the passport chip against the issuing authority's Public Key Infrastructure (PKI) Country Signing Certification Authority (CSCA). Upon validation, the app generates an ICAO-compliant DTC (Type 1 virtual component and DTC Type 2 bound physical link) signed cryptographically and stored in the user's mobile wallet.

c) **Liveness Matching & Travel Pairing**: The traveller performs a real-time liveness selfie check, which is matched 1:1 against the high-resolution facial image retrieved from the e-Passport chip. The passenger then scans or links their international flight boarding pass.

d) **Consent-Based Token Push & Border Clearance**: Prior to arriving at the airport, the passenger explicitly consents to share the encrypted travel token with the departure airport's digital identity manager. Upon arrival at the terminal, e-Gates fitted with facial recognition cameras match the passenger's live face against the pre-staged token in under two seconds, granting entry, security access, and immigration clearance.

3.3 **Inter-Agency Governance and Regulatory Reform**: Crucial regulatory authorization was achieved on 1 September 2026, when the Bureau of Immigration (Ministry of Home Affairs) formally authorized the acceptance of digital electronic boarding passes and biometric verification at all international airport immigration counters. This landmark reform eliminated physical paper stamping requirements for enrolled passengers, enabling automated immigration e-Gates to perform statutory exit controls while maintaining 100% auditability and border security integrity.

4. POLICY, ECONOMIC, AND REGULATORY IMPLICATIONS FOR GLOBAL AVIATION

4.1 **Infrastructure Resilience and Capacity Optimization**: By replacing manual document checks with automated biometric e-Gates at international departure touchpoints, airports can increase passenger throughput capacity by up to 250% without expanding physical terminal footprints. This offers a highly cost -effective solution for airport concessionaires facing acute terminal congestion, directly advancing ICAO's Strategic Goal: *The Economic Development of Air Transport Assures the Delivery of Economic Prosperity and Societal Well-Being for All*.

4.2 **Scalability for Emerging Economies -No Country Left Behind (NCLB)**: Because India's Digi Yatra relies on open standards, commercial off-the-shelf mobile smartphone NFC readers, and standard ICAO DTC data structures, the system offers an easily replicable blueprint for developing Member States. Rather than deploying proprietary, vendor-locked biometric systems, States can leverage decentralized mobile wallet frameworks to implement world-class border facilitation at a fraction of traditional deployment costs.

4.3 **Cross-Border Interoperability and Trust Frameworks**: The full realization of global seamless travel requires bilateral and multilateral trust framework agreements. Key technical and regulatory hurdles currently include cross-border PKI certificate validation, real-time Master List exchange under the ICAO Health Master List and Public Key Directory (PKD), and harmonized consent-based data privacy governance across jurisdictions.

5. CONCLUSION

5.1 The Conference is invited to note the information contained in this paper.

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