Analysis of the SmartGate MRZ and e-Passport Kiosks

Location

Sydney and Melbourne International Airports
Australia

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The following analysis was conducted at the request of Mr Ranald Kennard, Manager Traveller Strategies Australian Customs Service (ACS). The Project Officers in the ACS Canberra Office also involved Ms Kim Marshall, Ms Ellen Brophy and Mr Mark Collidge.

The analysis included:

1. Review of video recordings of users of the SmartGate kiosk at the Australian Customs Service Office in Canberra and in the Control Room at the Melbourne International airport

2. Review of the SmartGate kiosk in the test laboratory in Canberra

3. Observations of the use of the SmartGate kiosks by Qantas aircrew and enrolled frequent flyer passengers at the Sydney International Airport (10th and 11th January 2005) and the Melbourne International Airport (20th and 21st January 2005)

4. Overview of the design drawings provided by Australian Customs Service

5. Analysis and report

The aim of the analysis is to:

1. Identify the user interaction patterns with the SmartGate MRZ and the e-Passport kiosks

2. Provide recommendations for improved user interactions in relation to the existing SmartGate kiosk designs

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EXECUTIVE SUMMARY

Mr Ranald Kennard and his Project team in the Australian Customs Services office in Canberra ACT requested the analysis of the SmartGate MRZ and e-Passport kiosks of ACTSAFE Australia. ACTSAFE Australia has undertaken an initial analysis of the SmartGate Machine Readable Zone (MRZ) kiosk in April to June 2004.

This analysis includes comparisons between analysis findings from June 2004 to the current SmartGate MRZ kiosk. The analysis considers the human interaction elements with the existing SmartGate MRZ kiosk and the new SmartGate e-Passport kiosk for all user groups, i.e. Qantas aircrew and passengers.

This analysis was conducted in the test laboratory in Canberra and on site at both the Sydney and Melbourne International airport sites between December 2004 and February 2005.

The scope of the analysis is limited by sample size whereby a large sample size for Qantas aircrew SmartGate MRZ kiosk users was obtained (280 at Sydney International airport and 58 at Melbourne international airport) and a small sample size was obtained by SmartGate MRZ kiosk passenger users (3 at Sydney International airport and 17 at Melbourne International airport). The sample size for the e-Passport users was small (15 at Sydney International airport and 0 at Melbourne international airport).

The summary of findings following the analysis include:

1. Human interaction with the Qantas aircrew experienced users.

Generally the improved efficiencies for the experienced user group included:

- Preparation in the approach to the kiosk with a) the passport to hand, b) the hats removed, c) a hand free to remove glasses (if not already) and d) luggage positioned in line with the gates for prompt passage through the gates
- Aircrew who were unprepared for a transaction pulling to the side of the queue to organise their passport and paperwork prior to joining the queue
- Effective placement of the passport
- Clear passage through the gates without obstruction
- Aircrew who were unsuccessful in their transactions would immediately progress to the red line for manual processing by Customs Officers

Generally the reduced efficiencies noted included:

- A reduced rate of successful transactions from 94% to 87.3%
- A casual approach to the kiosk where talking and laughing behaviour with colleagues was adopted whilst attempting to perform facial recognition at the kiosk

2. The introduction of the passenger user group to the SmartGate MRZ kiosk.

Generally the efficiencies demonstrated by the passenger user group included:

- Prompt passage through the Customs Control point
- Attentive behaviours when interacting with the kiosk
- A reasonable level of successful transactions (75%) and priority for manual processing with a Customs Officer following an unsuccessful transaction
- Generally less volume of luggage to handle through the kiosk gates than aircrew members

Generally the inefficiencies demonstrated by the passenger user group included:

- Infrequent disorganisation of large volumes of luggage and passage through the gates in the allocated time
- Confusion with the identity of the SmartGate MRZ from the e-Passport kiosk

3. The introduction of the SmartGate e-Passport kiosk

Generally the favourable behaviours included:

- Those previously stated for the experienced user group
- Increased one handed use with the passport reader

Generally the unfavourable behaviours included:

- Those previously stated for the experienced user group
- Confusion in the orientation for placement of the passport
- A reduced rate of successful transactions from 94% on the initial analysis of the SmartGate MRZ kiosk to 73.3 % for the Smartgate e-Passport kiosk

4. Areas of focus for improvement to the existing designs of the Smartgate Kiosks

- Consistency in the design of the passport reader on both machines
- Queuing arrangements
- Establishing improved user confidence in the use of the Smartgate e-Passport kiosk
- Review the potential to increase the width of the gates for passage
- Review the potential impact with the ramp for smooth passage through the gates

1.0 Background information

The SmartGate kiosks have been developed with the aim to automate the identity verification process for aircrew and frequent flyer passengers crossing Australia's border.

The ACS in negotiation has developed the SmartGate kiosks with the other stakeholders; Passports Australia (Department of Foreign Affairs and Trade) and the Department of Immigration and Multicultural and Indigenous Affairs.

The initial SmartGate Machine Readable Zone (MRZ) kiosk was installed at the Sydney International Airport Custom's control point in November 2002. ACTSAFE Australia has undertaken an initial analysis of the SmartGate MRZ kiosk in April to June 2003. The findings of this analysis have been outlined in a report dated June 2003.

An extension to the trial program included the introduction of the SmartGate MRZ kiosk in Melbourne on the 13th September 2004.

A further extension to the trial program has been implemented from September December 2004 to include enrolled frequent flyer passengers. This group has been identified as regular overseas travellers. It has been estimated that approximately 2800 passengers have enrolled in the SmartGate MRZ kiosk program.

It is estimated that there are approximately 5000 Qantas aircrew enrolled in the SmartGate MRZ kiosk program.

Australian Customs Service and affiliated agencies has developed a new style of kiosk adopting differing technology for the reading of Passports. This new kiosk is described as the SmartGate e-Passport kiosk and requires the user to have an e-Passport to use this style of kiosk. The e-Passport has an electronic chip inserted in the middle page region of the passport. Qantas aircrew are the only selected group for the use of this machine.

The enrolment period for the e-Passport was commenced in November 2004 at both the Sydney and Melbourne International airports. It is estimated that approximately 2229 Qantas aircrew have enrolled and of these 1120 have been issued with the new e-passport.

The use of the SmartGate e-Passport kiosk commenced on the 18th December 2004 in Sydney and on the 21st December 2004 in Melbourne.

It is understood that Qantas aircrew are informed not to use the SmartGate kiosks when travelling as passengers on a flight. The kiosk will not process an automatic transaction when aircrew are not registered in the system database as expected incoming crew.

2.0 Scope

This further analysis is a component of the evaluation process of the SmartGate kiosks coordinated by the Australian Customs Service.

Concurrent evaluation of the SmartGate kiosk is being conducted by way of analysis of the electronic transaction data, provision of questionnaires to users and interviewing users. Other evaluators are conducting these activities.

This analysis focuses on observations of the Qantas aircrew and frequent flyer passenger interactions with the SmartGate MRZ kiosk and the SmartGate e-Passport kiosk. There was not the opportunity to interview the users or explore verbal protocol evaluation methods within the scope of this analysis.

The physical interactions and user behaviours are observed in this analysis. This includes the approach to the SmartGate kiosks, the interaction with the kiosks and the passage through the Customs control point.

The analysis of findings obtained from the user interviews and questionnaires will provide more interpretative data in respect to the psychological aspects of the user interactions.

The aim of this further analysis is to review the following aspects:

5. Overall findings for the use of the SmartGate MRZ kiosk

6. Overall findings for the passenger user group of the SmartGate MRZ kiosk

7. Overall findings for the Qantas aircrew user group of the SmartGate MRZ kiosk

8. Overall findings for the Qantas aircrew user group of the SmartGate e-Passport kiosk

9. Comparison between the SmartGate MRZ kiosk user group at the Melbourne and Sydney International airports

10. Comparison between the e-Passport Qantas aircrew user group at the Melbourne and Sydney International airports. This aspect did not occur as there were no SmartGate e-Passport user transactions available for observation at the time of the analysis at the Melbourne International airport

3.0 Methodology

In the performance of this analysis the following was undertaken

3.1 Review of available design documentation. This primarily included the dimensions of the ramp structure positioned between the gates on both kiosks.

3.2 Review of the videotapes. This included the user interactions with both the SmartGate MRZ kiosk and the SmartGate e-Passport kiosk with all user groups at the Melbourne International airport over various periods between the 17th and 21st January 2005. It also included user interactions with the SmartGate e-Passport kiosk at the Sydney International airport taken between 8.15 am on the 2nd and 7.35 am on the 3rd of February 2005.

3.3 Observation and recording of 'live transactions' on-site at the Sydney International airport on the 10th and 11th January 2005 and at the Melbourne International airport on the 20th and 21st January 2005.

The interactions were recorded on checklists and later tallied to reflect user characteristics and behaviours including;

- Queuing and user movements
- Luggage volume
- Gender
- Stature
- Requirement for the removal of glasses and/or hats
- Passport handling
- Number of user trials adopted with the kiosks
- Interference with the gates and/or ramp

Further observations were made of

- Interactions between aircrew
- Interaction of aircrew with Customs Officers
- Customs Officers interventions

3.4 Photographic recording of the approach and the SmartGate kiosks at both the Sydney and Melbourne International airports and of the kiosks in the Canberra test laboratory.

3.5 Review of the SmartGate MRZ and e-Passport kiosks in the test lab in the Australian Customs Service Office in Canberra.

3.6 Interview Customs Project managers and trained officers on the SmartGate kiosks.

3.7 Recording of user feedback in the performance of their transactions.

4.0 Information Tools

Customs have developed some brochures for user information. The brochures are available in the enrolment office and at the time of enrolment.

4.1 "Introducing SmartGate" -September 2004 (tri-fold A 4 size, 210 x 99 mm)

This brochure provides a background to the trial project with the SmartGate kiosk and step-by-step instructions for the use of the SmartGate kiosk.

A SmartGate specific website has been provided to enable feedback to be obtained and as a support for users.

Telephone and email details on the Customer Information and Support Centre have also been provided in this brochure.

4.2 "SmartGate and Your Passenger Card" (single sided notice 30 x 10 mm)

This notice provides a brief outline of the steps involved in the passage through the Customs Control point.

4.3 Guide for e-Passport SmartGate (pocket size 102 x 75 mm)

This two-sided brochure provides step-by-step instructions for the use of the e-Passport SmartGate kiosk

4.4 Guide for (MRZ Reader) SmartGate (pocket size 102 x 75 mm)

This two-sided brochure provides step-by-step instructions for the use of the MRZ Reader SmartGate kiosk.

4.5 Customs Officer

The SmartGate trained Customs Officers are positioned at the Aircrew and APEC front line at the Customs Control Point.

At times they are in a position to walk up to the SmartGate kiosks and provide verbal assistance or demonstrate the use of the kiosk.

5.0 Operation of the SmartGate kiosks

5.1 General principles

The user approaches the SmartGate kiosk situated alongside the Aircrew processing channel at the Customs Control Point.

In use of the SmartGate kiosk the following is required:

- Removal of hats and sunglasses
- Place open passport (MRZ) or closed Passport (e-Passport) on the passport reader
- Look straight ahead (at the cameras)
- Proceed through the entry gates to the luggage claim area once your identity has been verified and a green arrow is received to indicate a successful transaction

There may be a few reasons for the unsuccessful automatic transaction of the SmartGate kiosk whereby a user is signalled by the presence of a blue arrow to proceed to the Customs Officer control point for manual processing. These include:

1. Poor facial matching
2. Non registration for the aircrew member to be arriving on the specified flight
3. Confidential security procedures
4. Poor passport read (poor placement, damaged passport)
5. No enrolment of the user with the SmartGate kiosk program
6. Gate closure prior to user passage (in the allocated 6 second time frame)

Note: If not successful on the first attempt, the user can try again or proceed to the Customs Control counter for manual processing by a Customs Officer. There is only value in trying again if there has been a poor passport read or if there has been poor facial matching.

The information brochure encourages unsuccessful users to attempt a second transaction prior to proceeding to a Customs Officer for manual processing.

5.2 Operation of the SmartGate MRZ kiosk.

The user approaches the kiosk in turn with their cabin luggage. They require their passport for a transaction with the kiosk.

On the SmartGate MRZ kiosk, below the cameras there are three stage instructions:

1. *"Place" with the picture of a passport placed to the reader*
2. *"Look" with the picture of a camera with the yellow light illuminated*
3. *"Go" with a picture of the camera with the left and right direction arrows represented*

Photo 1: The placement of the passport to the passport reader is represented with an upward arrow symbol. The three-stage process is illustrated above the passport reader.

The panel above the reader is illuminated in a green colour whilst the user positions the passport on the reader and awaits a successful read. Upon a successful read the panel is turned off and does not return to green until he user has successfully transacted through the gates or received the blue arrow to proceed for manual processing.

A red light will appear to indicate a bad passport read. The green light will reappear once the passport reader is ready to resume a passport read.

Photo 2: The cameras are located are at three positions (approximately 1450, 1650 and 1850 mm above the floor)

Photo 3: Each of the cameras is fitted with three signal lights. An orange light located centrally and to the top of the camera indicates that the cameras and data matching process are in operation. A green arrow is located to side of the camera, which becomes illuminated upon a successful transaction.

Photo 4: A blue arrow is located to the side of the camera, which becomes illuminated when the user is required to proceed to the Customs Officer for manual processing.

Photo 5: Upon receiving a green illuminated arrow indicator the user proceeds to the automatic gates for passage through the Customs Control point.

5.3 Operation of the SmartGate e-Passport Kiosk.

The user approaches the kiosk in turn with their cabin luggage. They require their passport for a transaction with the kiosk.

Photo 6: The cameras are located are at three positions (approximately 1400, 1650 and 1900 mm above the floor)

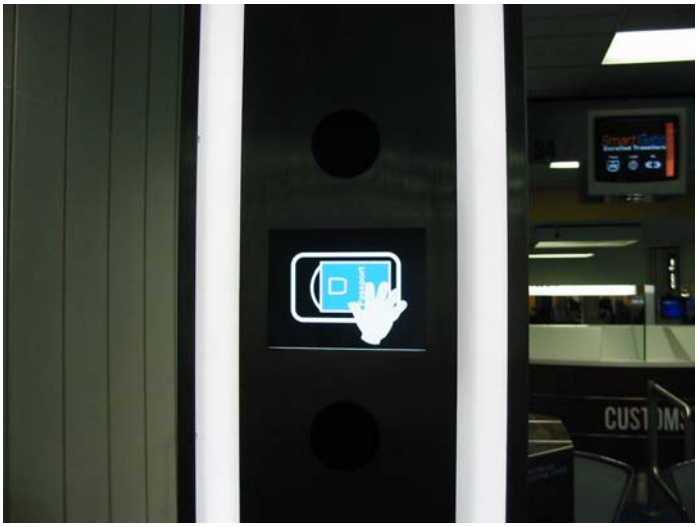


Photo 7: The LCD screen is positioned between the cameras positioned at 1400 and 1650 mm above the floor. This flashing two-stage instruction indicates the instruction to place the passport to the reader.

Photo 8: The LCD indicates the instruction to place the passport to the reader.

Photo 9: The placement of the passport to the passport reader. Note the green arrow to the base of the reader and the illuminated symbol to reflect passport placement.

Photo 10: The LCD screen displays a red crossed circle symbol to indicate an unsuccessful passport read or non-operability of the kiosk

Photo 11: The LCD screen displays a green arrow to indicate a successful passport read.

Photo 12: The LCD screen displays the symbol of an eye to indicate to the user to look at the cameras ahead

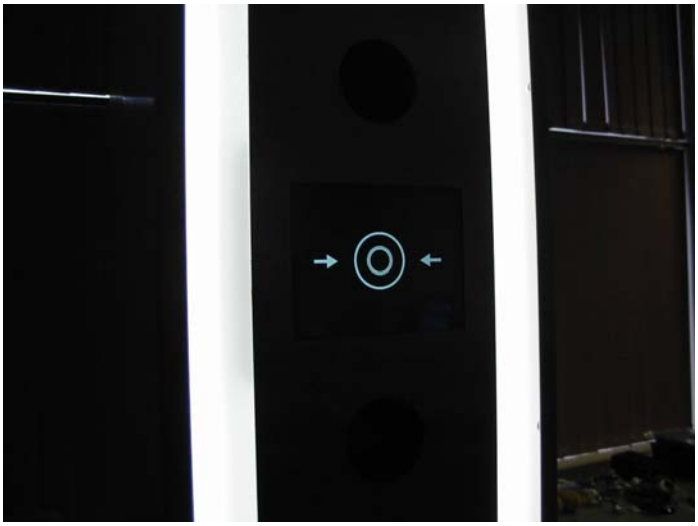


Photo 13: The LCD screen displays the symbol of a camera to indicate to the user to look at the cameras ahead

A green arrow appears for a successful transaction to indicate to the user to proceed through the gates. A blue arrow appears if the user is required to progress to the Customs Officer.

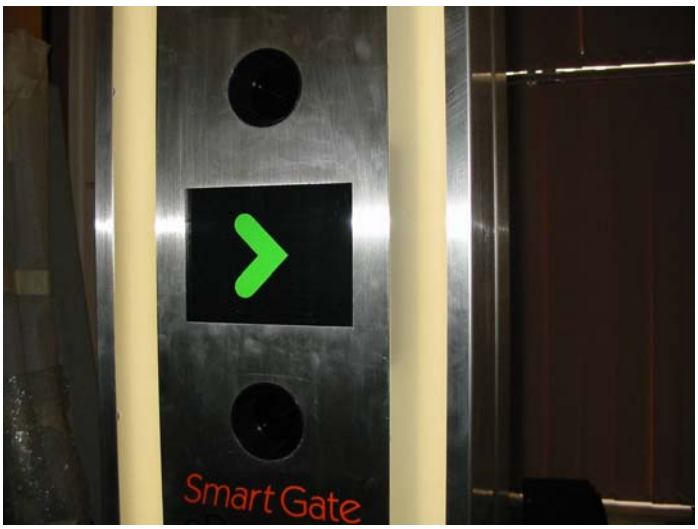


Photo 14: The LCD screen displays a green arrow to indicate a successful passport read and to proceed to the gates

Upon receiving a green illuminated arrow indicator the user proceeds to the automatic gates for passage through the Customs Control point.

Photo 15: The LCD screen displays a blue arrow to indicate to the user to proceed to the Customs Officer for manual processing.

Upon receiving a blue illuminated arrow indicator the user proceeds to the Customs Officer for manual processing for passage through the Customs Control point

6.0 SmartGate MRZ kiosk development

Certain design changes have been made to the SmartGate MRZ kiosk over the course of the trial program. These include:

- Positioning of a red circle on the floor in front of the kiosk to indicate the position for the user to stand when interacting with the kiosk

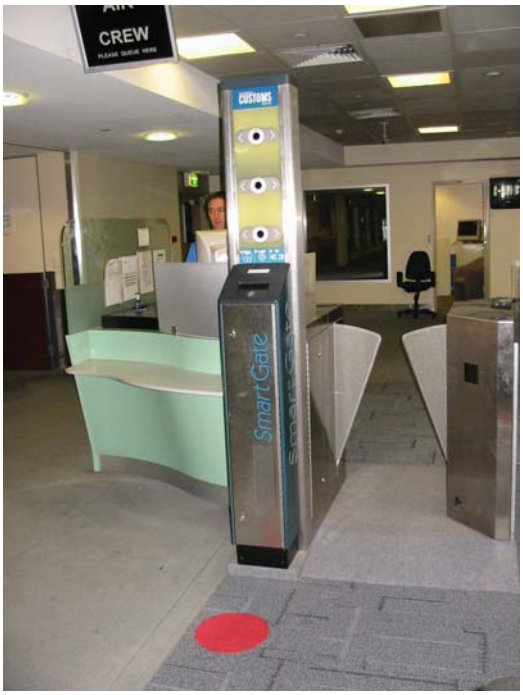


Photo 16: A red carpet circle has been integrated into the carpeted floor surface to indicate positioning when interacting with the kiosk.

- Provision of four sensors along the vertical line of the automatic gates to minimise the risk the gates of closing on a kiosk user or their luggage.

- Provision of additional time for the user to pass through the gate. It is understood that there is 6 seconds allowed, following a half second lag time from the time of a successful transaction (indicated by the green arrow) to the closing of the gates. There is an additional 1-second lag time from the time of activating the sensor in the gate. The gates remain open whilst the sensors are activated.

- Frosting of the gates to improve visibility

- Replacement of the passport reader with a self-directing pad and arrow to indicate placement.

- Replacement of the instructional symbols on the face of the kiosk. The branding of the “Place”, “Look” and “Go” is in use on the kiosk in addition to the instructional brochures

- Placement of the kiosk on an approximately 50 mm high graded ramp which houses the electrical cabling which passes between the two sides of the kiosk gates

7.0 Layout of the SmartGate MRZ and e-Passport kiosks

7.1 Sydney International Airport

The SmartGate MRZ and e-Passport kiosks are located alongside each other to the left hand aspect of the primary line at the Customs Control point. They are positioned forward of the primary line on the incoming approach. The Smartgate e-Passport kiosk is positioned forward and to the right hand side of the SmartGate MRZ kiosk. The Baggage Claim Area is directly ahead down a flight of steps.

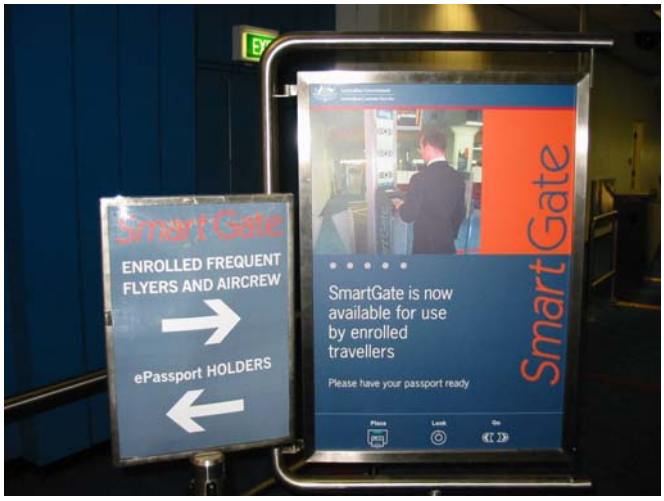
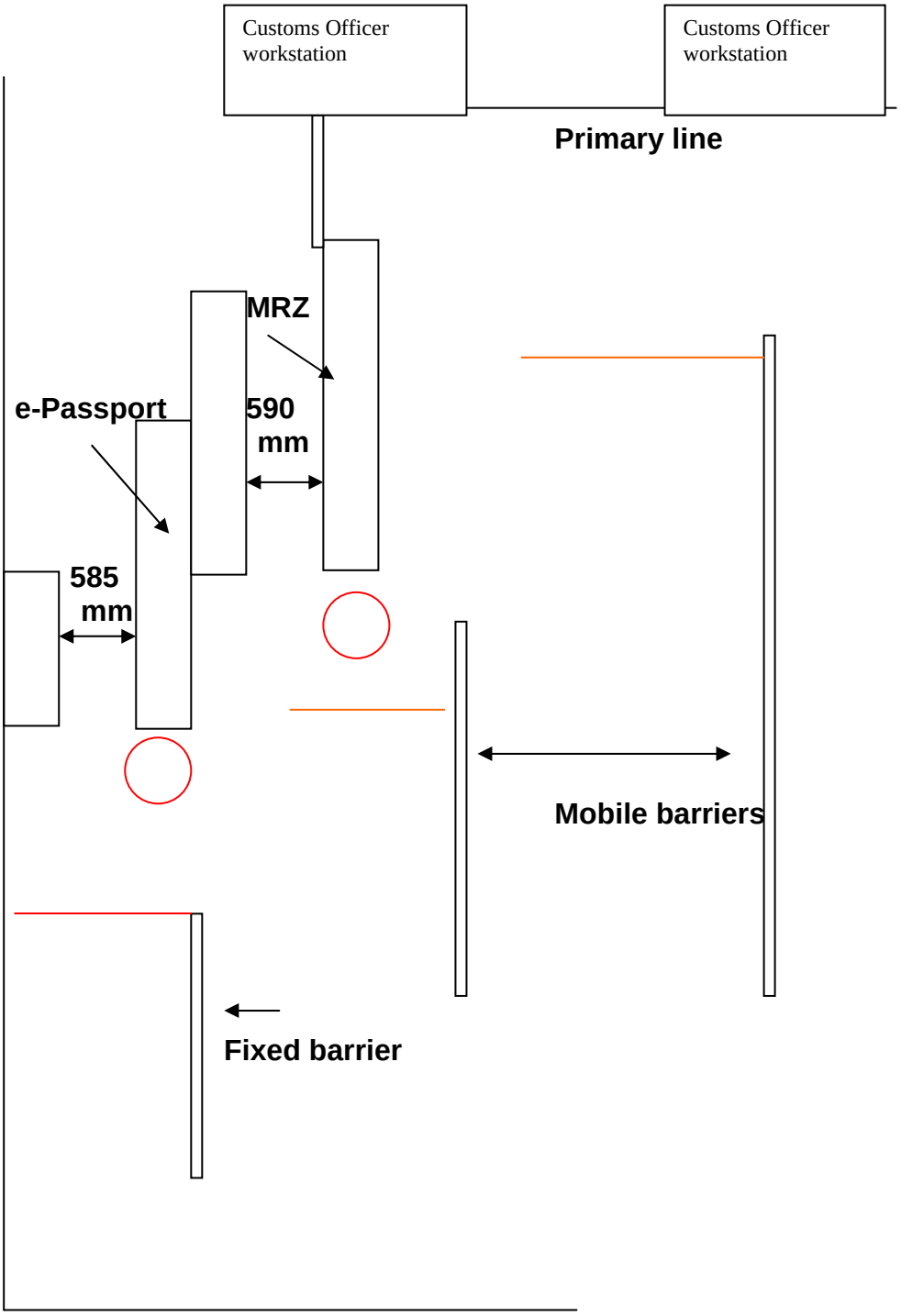


Photo 17: Upon approach to the kiosks, signage is provided to direct e-Passport holders to the left and the Enrolled Frequent flyers and Aircrew to the right.

Photo 18: Upon approach to the kiosks, a fixed metal barrier is installed between the lines.



Sketch A: Approximate layout of the kiosks at the Sydney International Airports

7.2 Melbourne International Airport

The SmartGate MRZ and e-Passport kiosks are located alongside each other and are integrated into the primary line at the Customs Control point. The SmartGate e-Passport kiosk is positioned to the right hand side of the Smartgate MRZ kiosk. The gates of both kiosks are aligned.

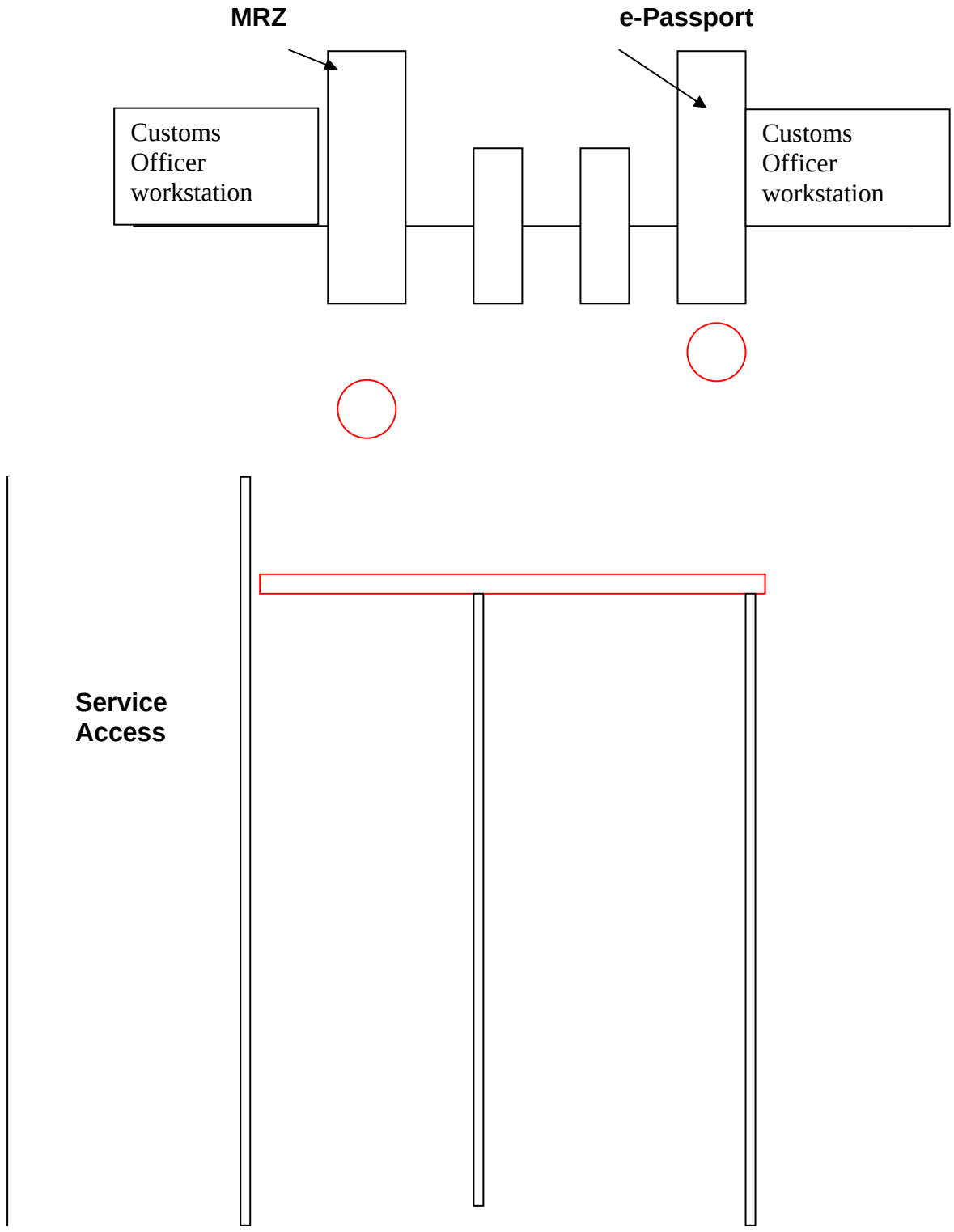
Positioned to the left hand side of the SmartGate MRZ kiosk is a manual Customs control workstation, which is used for processing Aircrew and Disabled passengers. To the right of the SmartGate e-Passport kiosk is a manual Customs control workstation that is used to process D Pass Holders, APEC and Diplomatic Passport holders.

The Baggage Claim area is to the right of the SmartGate kiosks, down a ramp and a flight of steps.

Photo 19: Approach to the kiosks. The MRZ and the e-Passport lines are in a continuos path from the corridor leading down from the arrival lounges. A fixed metal barrier is installed to the left hand side of the kiosks, which separates the service access from the MRZ kiosk line.

Photo 20: A mobile barrier is positioned between the SmartGate MRZ and the e-Passport kiosk lines.

Photo 21: The Customs control counter to the left of the kiosks used for manual processing of the aircrew, disabled passengers (utilising airport transport) and regular passengers (at times when there is no queue with aircrew).



Sketch B: Approximate layout of the kiosks at the Melbourne International Airports

8.0 Results of the Analysis

8.1 Observations of the Video recordings made available

The video recordings taken between 8.00 am on the 2nd February and 7.35 am on the 3rd February 2005 at the Sydney International airport were reviewed at Customs House on the 9th February 2005.

There were a total of 45 users of the Smartgate e-Passport kiosk observed over this period. Of this user group, 64.4 % were male and 35.6 % were female.

The users generally demonstrated good organization in their approach to the Kiosk. Of the sample, 49% demonstrated right-handed placement of the passport on the reader, 29 % left handed use and 22% bilateral hand use.

The users have been instructed to attempt a second passport reading if they are unsuccessful on their first trial. The users demonstrated between one and up to five trials at the kiosk. The table below summarises the patterns of trial noted with users.

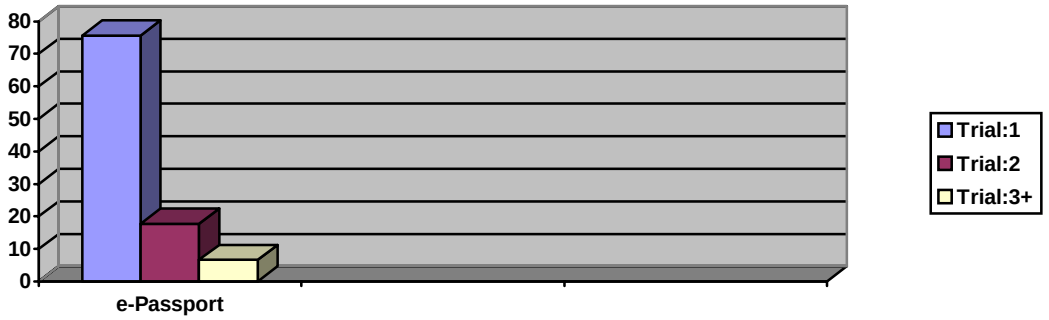


Table 1: Trials adopted by the SmartGate e-Passport kiosk users as observed on video recording (%). Sample size 45.

There were 60 % of users who were successful on their first passport placement and received a green arrow to proceed to the gates. There were 75.6 % overall who were successful with the transaction following one or more trials at placing the passport on the reader prior to receiving a green arrow to proceed to the open gates.

8.2 Observations of user behaviour at the SmartGate kiosk

Sydney International Airport

Observations were made between approximately 7.15 am to 12.25 pm and 4.45 to 9.00 pm on the 10th January 2005 and between 7.15 am and 1.00 pm on the 11th January 2005.

Observations consisted of the following user groups:

User Group	Sample size	Gender
SmartGate MRZ kiosk: Qantas Aircrew	280	183 males (65.4 %), 97 females (34.6%)
SmartGate MRZ kiosk: Passengers	3	3 males (100 %) 0 females
SmartGate e-passport kiosk: Qantas Aircrew	15	8 males (53.3 %) 7 females (46.7%)

Table 2: User groups observed on-site at Sydney International Airport

The aircrew were arriving on flights from Cairns, Auckland, Wellington, Christchurch, Noumea, Narita, Johannesburg, Singapore, Bangkok, Jakarta, Hong Kong and Los Angeles over this period. The estimated flying times were approximately three and a sixteen hours flight duration.

Melbourne International Airport

Observations were made between approximately 6.15 am to 1.00 pm on the 20th January 2005 and between 7.15 am and 1.00 pm on the 21st January 2005.

Observations consisted of the following user groups:

User Group	Sample size	Gender
SmartGate MRZ kiosk: Qantas Aircrew	58	32 males (55.2 %), 26 females (44.8 %)
SmartGate MRZ kiosk: Passengers	17	14 males (82.4 %) 3 females (17.6%)
SmartGate e-passport kiosk: Qantas Aircrew	0	0

Table 3: User groups observed on-site at Melbourne International Airport

The general findings include:

The following unfavourable behaviours were observed in the on site observations of users of the SmartGate kiosks at both the Sydney and Melbourne International airports.

- Delay in movement of the queue due to verbal interactions with other aircrew members

- Assistance provided by Customs Officers

- Continued trials at the kiosk whilst waiting in the queue if another aircrew member was stationed at the Customs Officer counter.

- Continued trials usually lead to the user applying two hands to the passport whilst on the reader, when initially they commenced with one hand placement.

- Return to the kiosk for re-trial at the Customs Officer's suggestion

- Continued trials following the removal of glasses and/or hats

- Aircrew uncertainty of enrolment status with the e-Passport and whether current use was possible

- Bi-passing use of the SmartGate e-Passport kiosk and joining the queue for manual processing with the expectation that the kiosk and/or passport was not operable

- Confusion over the identity of the machines. Several enrolled Smartgate MRZ kiosk users attempted passage at the e-Passport kiosk.

- Unenrolled aircrew using the kiosk as a working surface to complete paperwork

- Aircrew would approach Customs Officer to lodge paperwork and then back track to the kiosk for processing

- Some of the SmartGate e-Passport kiosk users would apply the passport with the passport open and the photograph downward to the reader (as for the SmartGate MRZ kiosk)

- Some users would anticipate an unsuccessful read and position their luggage to the side of passage toward the Customs Officer station rather than the kiosk gates

- Users with unsuccessful transactions, particularly when two were observed in succession, lead the queuing users to proceed for manual processing rather than transacting with the kiosk. Those that did attempt an automatic transaction would tend to trial only once before proceeding to the Customs Officer for manual processing

- Variable level and nature of Customs Officer instructions

8.2.1 Luggage Handling (for all kiosk movements at both airports)

Of the male Qantas aircrew, there were 83.9 % who used a trolley case, 79.4 % who used hand held luggage and 33.1% who carried visible duty free items.

Of the female Qantas aircrew, there were 88.5 % who used a trolley case, 91.5 % who used hand held luggage and 39.2 % who carried visible duty free items.

The majority of aircrew would secure their hand held luggage on their trolley case when in use.

Of the male passengers, there were 59 % who used a trolley case, 88 % who used hand held luggage and 24 % who carried visible duty free items.

Of the female passengers, there were 66.7 % who used a trolley case, 66.7 % who used hand held luggage and 33.3 % who carried visible duty free items.

8.2.2 Requirement for the removal of hats and glasses

Of the male Qantas aircrew there were 15.2 % who removed their hats and 1.3 % (3 users) who did not remove their hats whilst using the SmartGate kiosk. All of the users who kept their hats on had a successful transaction.

Of the male users there were 4.5 % who removed glasses for the facial recognition. Of the female users were 2.3 % (three users) who removed glasses for the facial recognition. All of these users experienced a successful automatic transaction. There were two users who kept their glasses on and one of the two experienced a successful transaction.

Amongst the passenger users 25% removed their glasses and of these 80% experienced a successful transaction.

8.2.3 Passport Placement

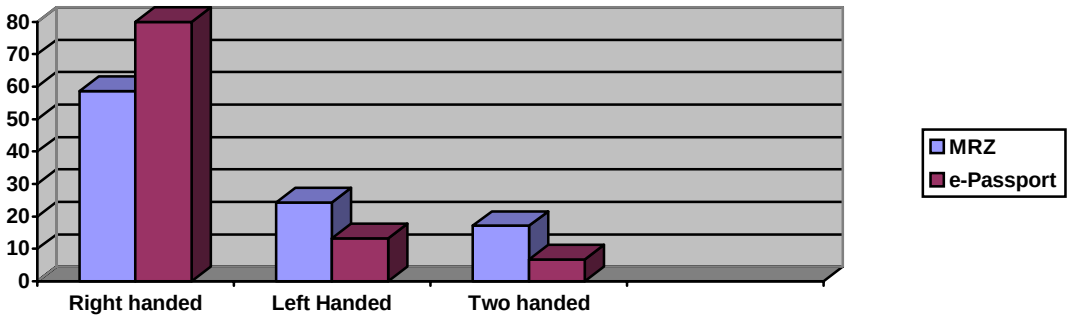


Table 4: Handedness demonstrated in use of the two types of SmartGate kiosks for all user groups (%)

Of the users of the SmartGate MRZ kiosk, there were 58.6 % who used the passport reader right handed, 24.3 % who used it left handed and 17.1% who used the reader with both hands.

Of the users of the SmartGate e-Passport kiosk, there were 80 % who used the passport reader right handed, 13.3 % who used it left handed and 6.7 % who used the reader with both hands.

8.2.4 Successful transactions

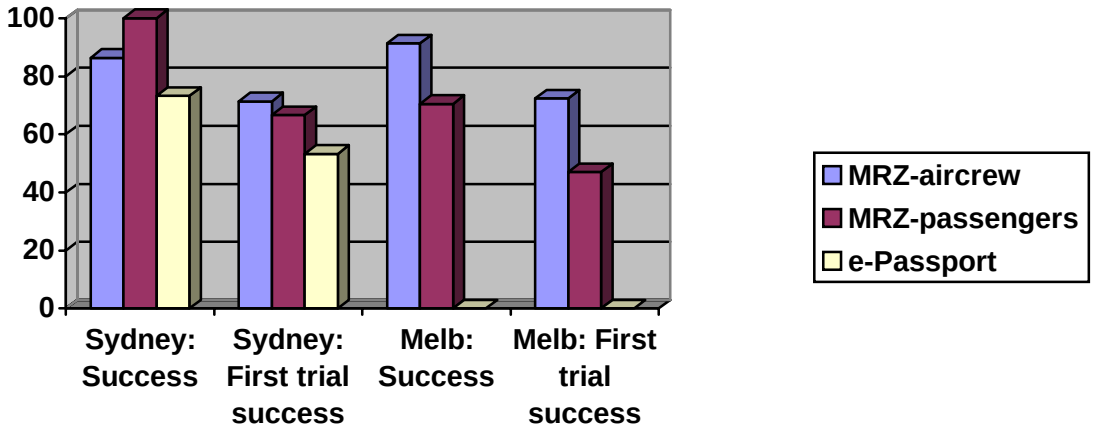


Table 5: Overall and first trial success rates (%) for the various machines and users at both Sydney and Melbourne Airport

Of the Qantas aircrew users of the SmartGate MRZ kiosk, there were 87.3 % who were successful in their transactions. Of the passenger SmartGate MRZ kiosk users, there were 75% who were successful in their transactions. Of the users of the SmartGate e-Passport kiosk there were 73.3 % who were successful in their transactions.

Of the unsuccessful Qantas aircrew SmartGate MRZ kiosk users, 28 % only attempted one trial of passport placement. Of the unsuccessful Passenger SmartGate MRZ kiosk users, 20 % only attempted one trial of passport placement. Of the unsuccessful Qantas aircrew e-Passport kiosk users, 50 % attempted one trial of passport placement.

8.2.5 Passage

Of the passenger users of the SmartGate MRZ kiosk gate, 10 % struck the sides of the gate on their passage through the gates without a smooth passage.

Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 7.1 % struck the sides of the gate on their passage through the gates without a smooth passage.

Of the Qantas aircrew users of the SmartGate e-Passport kiosk gate, there were no users to strike the sides of the gate preventing smooth passage through the gates.

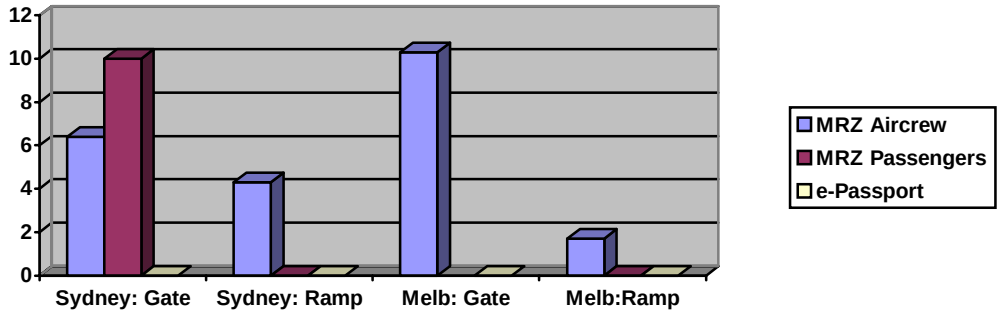


Table 6: Significant obstruction to smooth passage (%) observed with the various user groups of SmartGate kiosks at both Sydney and Melbourne International airports.

Of the passenger users of the SmartGate MRZ kiosk gate, nil struck the ramp or tripped on contact with the ramp on their passage through the gates. Note this was a small sample size.

Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 3.85 % struck the ramp or tripped on contact with the ramp on their passage through the gates. Of these 3.6% occurred at the Sydney International Airport.

Note: A modification to the gradient of the ramp has been adopted at the Melbourne International airport.

Of the Qantas aircrew users of the SmartGate e-Passport kiosk gate, nil struck the ramp or tripped on contact with the ramp on their passage through the gates. Note this was a small sample size.

9.0 Customs Officer feedback

9.1 Discussions with the Project Manager and Customs Officer at the Sydney International Airport.

Feedback was obtained from Mr Karel Jenicek, on-site ACS Project Officer and other SmartGate trained Customs Officer at the Sydney International Airport on the 10th and 11th January 2005.

The following summary of feedback from the Customs Officers includes:

- The provision of verbal prompts, eg “smile” or “try again” assisted in achieving a successful transaction or a repeated attempt following the first unsuccessful attempt.

- Unsuccessful transactions occur due to;

    - Poor placement of passport

    - User not remaining stationery in front of cameras

    - User engaging in conversation when in front of cameras

    - User wearing hat

    - User wearing different spectacles

    - User not smiling for the camera

- Generally a great efficient method to process users through the Customs Control Point

9.2 Discussions with the Project Manager and Customs Officer at the Melbourne International Airport.

Feedback was obtained from Mr Tim Pullybank, on-site ACS Project Officer and other SmartGate trained Customs Officer at the Melbourne International Airport on the 20th and the 21st January 2005.

The following summary of feedback from the Customs Officers includes:

- Interference by non-users with the SmartGate kiosks, i.e. children banging on the gates, Passengers leaning on the kiosk to complete paperwork

- The users who achieve the best performance are those who are single travellers, i.e. passengers and those, which are attentive to the application, i.e. passengers and aircrew.

- Unsuccessful transactions occur due to;

    - User not looking at the cameras

    - User engaging in conversation when in front of cameras

    - User laughing when positioned in front of the camera

- Frequent Flyer passengers often have large amounts of hand luggage due to Business Class provisions

- Width of gates should be greater

10.0 Ergonomic considerations for the SmartGate kiosk

10.1 Approach to the kiosk and queuing behaviours

Sydney International Airport

The approach to the Customs Control point is clearly signed to enable the left hand passage to SmartGate e-Passport users and the right hand passage for enrolled frequent flyers and aircrew.

Photo 22: Signage on approach to the SmartGate Kiosk

There is ineffective queuing occurring where the majority of SmartGate users were using the same queue, i.e. taking passage to the right hand lane to the Enrolled frequent flyers and aircrew line.

On the approach to the sign and to the SmartGate lines, passage was impeded at time by the presence of a long queue for the “Aircrew, D Pass Holders, APEC, Diplomatic Passport” line. This results in an unnecessary delay and congestion for enrolled aircrew.

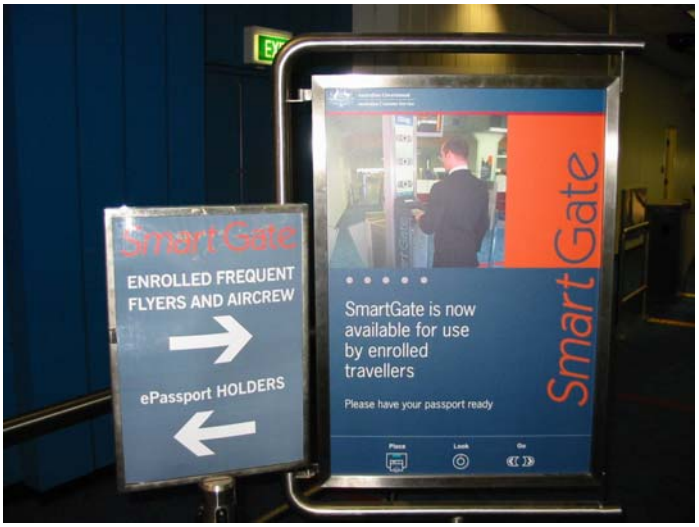


Photo 23: Signage on approach to the SmartGate Kiosk.

Photo 24: Signage for Aircrew, D Pass Holders and APEC passengers near to the approach to the SmartGate Kiosk

Photo 25: Barriers and Signage on approach to the SmartGate Kiosk

Photo 26: Permanent barrier and Signage on approach to the SmartGate Kiosk

Melbourne International Airport

The approach to the Customs Control point is a continuum of the corridor, which leads from the arrival lounges. A t times this was observed to result in passengers joining the queue for SmartGate.

There is a sign positioned at the start of the line, which is labelled to indicate right hand passage for the Smartgate e–Passport kiosk users and the left hand passage for enrolled frequent flyers and aircrew.

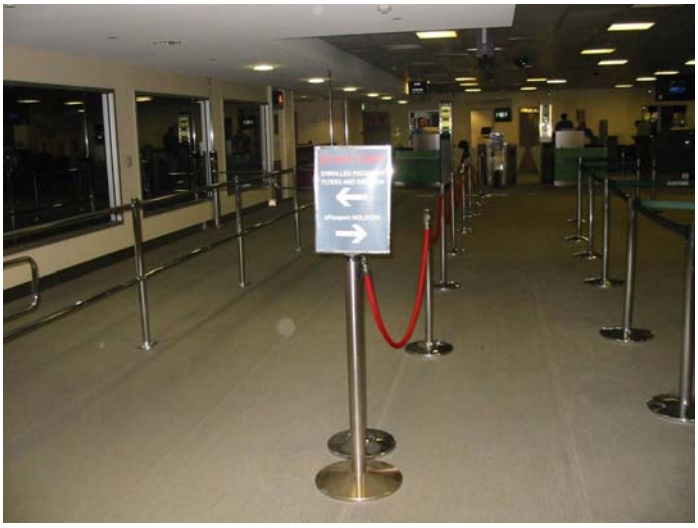


Photo 27: Barriers and Signage on approach to the SmartGate Kiosk (Melbourne)

A smaller sign is positioned on the top of the support to the gates to direct users to the appropriate machine.

Photo 28: Barriers and Signage on approach to the SmartGate Kiosk (Melbourne)

The width of the processing lines requires consideration. The increased width of 2000 mm in Melbourne enabled passage of two persons side by side. This was observed when:

- Unprepared users pulled to the side of the line whilst accessing their passport
- Users pulled to the side of the line whilst awaiting another aircrew member
- Failed users stepped aside whilst another user came forward
- Failed users stood to the side whilst awaiting the Customs Officer's availability following an unsuccessful transaction
- Aircrew stood alongside a colleague whilst a transaction was occurring
- Aircrew withdrew from the line when they had chosen the wrong queue

Signage

The sign upon approach to the SmartGate kiosk and aircrew Customs Point has the following features:

a) Large size of 800 mm high and 570 mm wide

b) Positioned between 1040 and 1600 mm above the floor level

c) Important information is positioned approximately at the standing eye level (approximately 1040 to 1600 mm above the floor level)

d) Use of font size for "SmartGate" is 43 mm high for upper case and 30 mm for lower case. This should be legible from a distance of at least eight metres (Australian Standard (AS) 1428.2-1992)

e) Use of font size for ""Enrolled Frequent Flyers and Aircrew" is 18-20 mm high for upper case and 15 mm for lower case. This should be legible from a distance of at least four metres (Australian Standard (AS) 1428.2-1992)

f) Large white arrows to reflect direction of passage

g) The use of colour (white and red on a dark blue background) offers good colour contrast.

Note: *Where signs including symbols, numbering and lettering shall be located as follows; Signs should be placed within a zone at a height of not less than 1400 and not more than 1600 above the plane of the finished floor. Where a sign can be temporarily obscured, eg. In a crowd, the sign should be placed at a height of not less that 2000 mm above the plane of the finished floor. (AS 1428.2-1992)*

The labelling on the SmartGate e-Passport kiosk has the following features

h) Positioned between 1240 and 1400 mm above the floor level

i) Use of font size for “SmartGate” is 25 mm high for upper case and 16 mm for lower case. This should be legible from a distance of at least four metres (Australian Standard (AS) 1428.2-1992)

j) The use of colour (red on chrome background) offers good colour contrast for “SmartGate”

k) The use of colour (black on chrome background) may offer poor colour contrast, dependent on lighting conditions.

Photo 29: Labelling on the SmartGate e-Passport kiosk

There is confusion noted on the approach to the kiosks and on repeated occasions aircrew and passengers were approaching the wrong kiosk. There were 10 occasions noted where the user approached the e-Passport kiosk prior to proceeding to the MRZ reader kiosk.

Note: At Melbourne airport the e-Passport is positioned to the right and at Sydney the e-Passport is positioned to the left hand side.

Recommendations:

10.1 The signage used to direct users to the SmartGate e-passport or MRZ kiosk is ambiguous as "Aircrew" are directed to the right, although those Aircrew with e-Passports are required to proceed to the left.

The use of "e-Passport Aircrew" with the arrow pointing to the left may assist in directing aircrew to either the MRZ or e-Passport lines.

10.2 The placement of the sign at a higher level where the base of the sign is 1400 mm above the finished floor level and the primary reading zone is approximately 1550 to 2150 mm above floor level to improve visibility when users are approaching a queue.

10.3 Improved labelling on the kiosks to identify the e-Passport kiosk from the MRZ kiosk. I note that an additional sign was placed on the Smartgate e-Passport kiosk to assist in identification. Permanent labelling may be more effective. The legibility and lighting conditions for this require consideration.

It is advised that the labelling be placed as high as possible on the kiosk to enable view from a distance and whilst in a queue. Alternatively, the use of overhead signage may be effective, eg as for the monitors positioned above the Customs Officers workstations.

10.4 The increased width of the lines approaching the kiosks enabled unobstructed movement for users and those having to remove themselves from the queue for the reasons previously stated. The width of the machine and gates is approximately 1200 mm, which would be a reasonable minimum standard for the width of a line. This is a recommended width for a passage where two persons may be passing (SAA HB59-1994).

10.5 The approach to the SmartGate kiosk line may be obstructed at times when unenrolled international aircrew are queuing in the line positioned to the right at the Sydney International Airport.

Re-positioning of the barriers at the entry point to the line to enable access for enrolled aircrew to pass to the left of this queue is recommended.

10.6 The approach to the Smartgate kiosks is in direct line from the corridor leading from the arrival lounges and leads to passengers walking directly ahead into these lines for processing.

The use of barriers with signs positioned at eye level (1040 to 1600 mm above the floor level) and high level (>2000 mm above the floor level) to inform passengers to move to the right and join the line is required to minimise this confusion.

Position in relation to the cameras

A red circle (of approximate 370 mm diameter) has been marked on the carpeted floor to the front of the kiosk to indicate the position for the user to stand when undertaking a transaction. It is understood that the circle is set back at an appropriate distance from the e-Passport kiosk and the MRZ reader kiosk to achieve the required distance for the performance of the cameras and facial matching process.

These positions achieve a comfortable reaching distance for users of both tall and short stature.

The majority of users were observed to stand on the red circle when conducting a transaction.

Passport Reader

Handedness and Orientation

The majority of users were observed to use the right hand (58.6 % for the MRZ and 80 % for the e-Passport) and position the passport in the correct orientation on the first attempt.

A minority of the users of the e-Passport kiosk demonstrated the following unfavourable behaviours:

- Placement of the passport with the wrong orientation (passport open as for the MRZ).
- Placement of the passport to the flashing LCD screen positioned between the cameras

Recommendations

10.7 Consideration for consistency of passport reader interaction between the two styles of kiosks is advised to minimise the impact of altering learnt behaviours with the MRZ prior to change over the e-Passport kiosk.

The users of the SmartGate e-Passport kiosk demonstrated a higher level of unilateral (one handed) interaction compared to the users of the SmartGate MRZ kiosk. A reader, which encourages one handed passport placement, is preferable to ensure ease of use and whilst the user can maintain the other hand free to manage luggage, passport case, entry cards, glasses, hats and other personal items as required.

10.8 The use of auditory feedback to indicate a successful passport read. This may also minimise the unnecessary repeated trials from users who may assume that it has been an unsuccessful passport read rather than another issue that directs them to a Customs Officer.

Passport Reader Height

The height of the passport reader is best placed slightly below elbow height to enable a downward force to be applied by the hand to the passport cover whilst reading.

The height of the passport reader is positioned between approximately 1220 and 1260 mm above the floor level on the SmartGate MRZ kiosk. The height of the passport reader is positioned between approximately 920-960 mm above the floor on the e-Passport kiosk. The height of the SmartGate e-Passport kiosk reader is just below the elbow level for the majority of adults, independent of gender, ethnic origins and varying body dimensions.

As there are no standards, which specifically relate to the SmartGate kiosk or similar products, reference to the standard for Automatic Teller Machines may be considered as providing reasonable zones for the user interaction of feeding an identity source to a machine. Based on the recommendation provided in AS 3769 1990 it is stated that the *"user-interface of the ATM should be located within a zone which is not less than 685 mm and not more than 1370 mm from the finished floor, and not less than 500 mm from an internal corner".*

The AS 3769 is attempting to consider both an ambulant and non-ambulant population, and therefore may reflect lower values than that expected of an ambulant population, such as Qantas aircrew. It would therefore be considered reasonable to position the passport reader in the current height zones between 920 and 1260 mm.

Currently the passport reader is positioned at a downward angle towards the front edge of the approach to the kiosk. This results in the potential for an increased angle to the user's wrist as they place the passport on the reader.

This angled placement assists with the line of sight to the reader and the visual prompts provided.

Recommendation

10.9 Maintain the reader height in the zone of 920 to 940 mm would be reasonable. Further exploration of the effectiveness of maintaining the reader at an angle closer to the horizontal or even sloping the reader downward to the back edge may assist in effective guidance of the passport into the reader and in the same direction of the hand movement and consistent with gravity

Legibility of Instructions on the SmartGate MRZ kiosk

The size of the font on the instruction panel located above the passport reader is currently 10 mm for the upper case and 8 mm for the lower case of the “1. Place, 2. Look, 3. Go” instructions positioned on the SmartGate MRZ readable kiosk. This is considered sufficiently sized to read over a distance of two metres (AS 1428.2-1992).

Legibility of Instructions on the SmartGate e-Passport kiosk

The SmartGate e-Passport kiosk has an LCD screen positioned between the lower two cameras on the machine. This is 130 mm wide and 100 mm high. The displayed images (passport placement, eye, camera, green and blue arrows) on this screen vary in size, although for symbol sizes 60 mm x 60 mm a viewing distance or seven metres or less is acceptable.

The appropriateness of the choice of colours include:

- Flashing passport symbol placed on reader: blue and white against a black background provides for good contrast and legibility
- Camera and eye: white image against black background provides good contrast and legibility
- Directional arrows: Green and blue against a black background provide for good contrast and legibility
- Red crossed circle: Red against a black background provide for good contrast and legibility

Interpretation of the instructions

SmartGate MRZ kiosk

The signage instruction positioned directly above the passport reader is using the three step instructions as also indicated in the instructional brochures, i.e.

1. *“Place” with the picture of a passport placed to the reader*
2. *“Look” with the picture of a camera with the yellow light illuminated*
3. *“Go” with a picture of the camera with the left and right direction arrows represented*

On the passport reader is a white arrow on a dark background, which has clear legibility. The “up” directional arrow is to indicate the placement of the passport into the reader with an upward motion to the guide. This is well sized for legibility.

A white light panel is present above the arrow and passport reader, which is illuminated to green once a successful passport read, has been achieved. Green is a conventional and appropriate choice of colour to indicate progress to the next step of the process, i.e. “Look”.

Photo 30: Instruction on the placement of the passport on the reader of the SmartGate MRZ kiosk

Recommendation:

10.10 Provision of clear symbolic and possibly auditory instructions to "look ahead" following the successful read of the passport, i.e. receipt of the green light. It may be helpful to overlay the words "Look ahead" on the white panel above the reader to confirm the progress the stage 2, "Look".

Passage to gates

Upon receipt of the green arrow to the left hand side of the camera (Sydney) or the left or right hand side of the camera (Melbourne), the user is required to organise their passport and gather their luggage and proceed to the gates for passage through the Customs Control. Often this process takes time, particularly where only six seconds is available to reach the control gates.

It was noted that the experienced users, were organised with their passport in an accessible location, or already in their hand as they approached the kiosk. The majority of users also demonstrated good organization of luggage, i.e. close to their reach and often in line with the gates to which they planned to proceed.

The use of the green arrow and the direction, i.e. passage in the direction is consistent with convention. The positioning of the green arrow at approximate eye levels ensures that the user captures the signal in the visual range.

Passage through gates

The internal width of the gates is approximately 580-590 mm wide. Whilst the majority of the aircrew are using a trolley case with additional hand baggage strapped on top, the overall width of luggage is approximately 400-500 mm wide. This width does not enable the unobstructed carriage of larger items, eg suit bags.

Qantas aircrew are required to meet cabin baggage allowance dimensions and weights. It is understood that these requirements are not enforced.

The users were generally observed to pass through the gates in a well-ordered and controlled movement.

The pre-set time of 6 seconds from the time of a successful facial recognition (transaction) to the passage to the gates appears appropriate for an experienced user population with the knowledge that the gates will be inoperable within a prescribed time frame.

The new user group of passengers generally demonstrated prompt passage through the gates. Of the passenger group, 5% were unsuccessful in achieving passage through the gates in the allocated time. Overall the passengers had less hand luggage to manage as they passed through the gates.

The Qantas aircrew passing through the SmartGate MRZ kiosk gates failed to meet the time frame on the gates on 0.9% of the transactions observed.

Recommendations

10.11 Consideration of increasing the time frame allowed for passage through the MRZ kiosk gates to 7- 8 seconds to ensure comfortable passage without perceived delay by the next user of the SmartGate kiosk. This would be important in the introduction stages of the kiosk to new user groups.

10.12 Review of the hand luggage allowances for Frequent Flyer passengers (especially business class) as some hand luggage items exceed the width of the gates, eg suit bags. This should be considered when determining the minimum width of the gates.

10.13 Widening of the internal gate width to 760 mm (consistent with doorway width standards) to enable increased width for clear passage to minimise the occurrence of striking the luggage on the internal aspects of the gate construction and consistent with user access experience through openings.

10.14 Ensure that there is control measures in place to ensure aircrew and passengers are complying with their cabin baggage allowances, with consideration also to the duty free allowances. This may assist in achieving a manageable level of baggage for handling through the Customs Control point.

Proceed to Customs Officer

For the user who does not receive the green illuminated arrow indicator light to proceed to the gates to the left, an alternate blue arrow to the right hand side of the camera (Sydney) or to the left and right hand side of the camera (Melbourne) is illuminated which represents that the user needs to proceed to a Customs Officer.

The choice of a blue arrow is consistent with the Customs Officers profile, although is varying from the theme of green for a successful transaction with the SmartGate kiosk. A user may expect red for an unacceptable transaction with the SmartGate kiosk. The use of red suggests failure, whereby the SmartGate kiosk may have been successful in performance, although this may not be fully understood by the user. The choice of blue is considered appropriate.

The choice of the blue ‘directional” arrow is consistent with the green “directional” arrow in use.

There appeared to be a clear understanding by the SmartGate users who received a blue arrow that they had priority over the other persons who may be in queue to perform a manual transaction with the Customs Officer at the control point. The SmartGate users would progress directly to the front of the queue and wait at the red line until the Customs Officer had completed any current processing.

The offset arrangement of the MRZ and the e-Passport kiosk was not observed to provide any obstruction to the passage of both users to the Customs Officer should this be required. At the time of the analysis there was a low number of e-Passport kiosk users observed. Over time the number of transactions at this kiosk is expected to increase and there may be the potential of the obstruction to the passage of the unsuccessful e-Passport kiosk across the MRZ user queue to reach the Customs Officer.

Recommendations

10.15 As there were a relatively low number of passengers observed in this analysis, there is a requirement to review this situation for passengers who are less familiar with the queuing priorities for Customs Officer processing following unsuccessful transactions. No unfavourable behaviours were observed within the scope of this analysis.

10.16 Review the queuing behaviours and clear passage at Sydney and Melbourne International Airports following an increase in user numbers on both the SmartGate MRZ kiosk and the e-Passport kiosk.

10.17 Ensure Customs Officers process the queuing SmartGate users in priority to the queuing unenrolled aircrew, as this is understood to be the accepted policy.

Instructions

The Customs Officer may provide instruction to SmartGate kiosk users. These vary from demonstration to verbal instruction. An inconsistent approach is adopted at times.

Recommendation:

10.18 Briefing to Customs Officers on a consistent and effective approach for provision of instructions to users of the SmartGate kiosk.

11.0 SUMMARY

The following summary of findings for this analysis is provided. When interpreting the results of the analysis it is important to note the variance in sample size between the different user groups and site locations. Therefore these results are only reliable in identifying potential trends. Larger numbers of user observations of the passenger user group for the SmartGate MRZ kiosk and the aircrew user group for the Smartgate e-Passport kiosk are required to reflect more accurately the user interactions.

The sample size for the SmartGate MRZ kiosk users was significant at the Sydney International airport (280 sample size) compared to the Melbourne International airport (sample size 58).

The passenger user group of the SmartGate MRZ kiosk was a low sample size (20 across both airport locations) as was the SmartGate e-Passport kiosk user group (15 at the Sydney International airport and nil at the Melbourne International airport).

The following overall observations have been made:

Overall differences noted with the use of the SmartGate MRZ kiosk between this analysis and the analysis performed in April to June 2002.

- Improved user organization of luggage and passport prior to the approach to the kiosk
- Improved queuing behaviour of an unsuccessful user to the front of the red line for manual processing by a Customs officer
- Improved preparation with the removal of hats and/or glasses on approach to the kiosk
- Overall their has been an increase in the number of luggage items carried by aircrew, in particular the use of trolley cases and hand held luggage by both the male and females. The percentage of visible duty free items has slightly decreased with female users.
- There were a lower percentage of male users removing their hats prior to commencing a transaction with the kiosks, i.e. one may assume that they had prepared by placing hats in luggage prior to the approach to the kiosk.
- There were a slightly higher percentage of males removing spectacles just prior to the transaction with a kiosk
- The overall success rate for transaction was 94% at the time of the first analysis compared to 87.3 % for the current analysis.

Differences between the positioning of the kiosk at the Sydney and Melbourne International Airports.

- Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 3.85 % struck the ramp or tripped on contact with the ramp on their passage through the gates. Of these 3.6% occurred at the Sydney International Airport.

- Queuing arrangements were more effective in the Melbourne International airport with the provision for the greater width of lines.

- Queuing arrangements at the Sydney International airport were impeded at the time by the presence of a long queue for the “Aircrew, D Pass Holders, APEC, Diplomatic Passport” line. This results in an unnecessary delay and congestion for enrolled aircrew.

Differences between the SmartGate MRZ and the e-Passport kiosks

- There was a greater percentage of right hand passport placement (80%) with the SmartGate e-Passport kiosk than the SmartGate MRZ kiosk (58.6%).

- There was a greater percentage of bilateral hand use with the SmartGate MRZ kiosk (17.1%) than the SmartGate e-Passport (6.7%)

- The rate of success of the Qantas aircrew SmartGate MRZ kiosk users was 87.3% compared to 73.3% for the Qantas aircrew SmartGate e-Passport users.

- The percentage of unsuccessful aircrew users who proceeded to the Customs Officer for manual processing after only one trial of the SmartGate MRZ kiosk was 28% compared to 50% for the SmartGate e-Passport users.

- Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 7.1 % struck the sides of the gate on their passage through the gates without a smooth passage whilst there were no Qantas aircrew SmartGate e-Passport kiosk users who struck the gates without smooth passage.

- Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 3.85 % struck the ramp or tripped on contact with the ramp on their passage through the gates. Nil were observed to strike or trip on the ramp for the Smartgate e-Passport kiosk users.

Differences between the Qantas aircrew and passenger user groups

- Overall, passengers tended to carry less cabin luggage and utilise hand held luggage in a higher volume than trolley cases.

- The rate of success for the Qantas aircrew SmartGate MRZ kiosk users was 87.3% compared to 75% for the passenger SmartGate e-Passport users.

- The percentage of unsuccessful aircrew users who proceeded to the Customs Officer for manual processing after only one trial of the SmartGate MRZ kiosk was 28% compared to 20% for the passenger Smartgate MRZ kiosk users.

- Of the passenger users of the SmartGate MRZ kiosk gate, 10 % struck the sides of the gate on their passage through the gates without a smooth passage where 7.1% of the Qantas aircrew SmartGate MRZ kiosk users struck the sides of the gate

- Of the Qantas aircrew users of the SmartGate MRZ kiosk gate, 3.85 % struck the ramp or tripped on contact with the ramp on their passage through the gates. Nil were observed to strike or trip on the ramp for the passenger Smartgate MRZ kiosk users.

12.0 References

- **Australian Standards**

9.1 AS 1428.1 General requirements for access-buildings

9.2 AS 1428.2 Enhanced and additional requirements-Buildings and facilities

9.3 AS 3769-1990 Automatic Teller Machines-User Access

9.4 AS 3590.1-1990 Screen based workstations Part 1: Visual Display Units

9.5 AS 4085-1992 Automatic sliding door assemblies

SAA HB59-1994

- **Worksafe Australia Anthropometric Data Base 1996-1998**