

**Aircraft Incident Report 01/05**

**Civil Aviation Authority  
Macao, China**

**Report on the ground incident to B747-400 and CRJ-700 at Macau  
International Airport on 16 September 2005**

## **Aircraft Information**

1. Manufacturer	The Boeing Company
Model	B747-45E
Registration	B-16402
State of registry	China (Taiwan)
Operator's Name	EVA Airways Corporation
Engine Type:	4 x CF6-80C2-B1F

2. Manufacturer	Bombardier Inc.
Model	CL-600-2C10 (CRJ-700)
Registration	B-KBB
State of registry	China (Hong Kong)
Operator's Name	CR Airways Limited
Engine Type:	2 x GE CF34-8C1

**Date of occurrence:** 16 September 2005

**Time of occurrence:** 0529 UTC  
(Local Time is 8 hours ahead of UTC)

**Location:** Macau International Airport

**Type of Flight:**

1. Public Transportation (Passenger)
2. Ferry Flight (after training)

## **Synopsis**

The Bombardier CRJ-700 (CRJ) was holding short runway 34 at holding point of Taxiway Delta for the departure slot after it had completed the training flight in Macau International Airport. The Boeing B747-400 (B747) was taxiing on Taxiway C2 and reported ready for departure. Macao Tower asked with the B747 if it can pass

behind the CRJ for departure. The B747 replied affirmative. While the B747 was passing behind slowly, its left winglet struck the left stabilizer of the CRJ. The left winglet of the B747 was damaged and the left stabilizer of the CRJ was damaged. After the separation of the aircraft, both aircraft were able to taxi back to apron for further inspection.

## **1 FACTUAL INFORMATION**

### **1.1 History of the flight**

In daylight with fine weather and good visibility, the CRJ arrived at 0355 UTC in that day for the training in Macau International Airport. After the CRJ had completed the training, it requested the Delta intersection departure for returning back to Hong Kong. Macao Tower Control approved the request and advised the CRJ that the approved departure time was 0530 UTC. CRJ acknowledged the clearance and held short of runway 34 at intersection Delta as approved.

The B747 landed at Macau International Airport at 0339 UTC was a schedule flight from Taipei to Macao. After the turnaround, the B747 started to push back at 0517 UTC as scheduled back to Taipei. When the B747 was taxiing on Taxiway C2 and reported ready for departure; Macao Tower Control asked the B747 if it can pass behind the CRJ for departure. The B747 replied “affirm”. Macao Tower Control acknowledged the reply and cleared the B747 to line up RWY34 and wait. As the B747 was passing behind the stationary CRJ, the B747 maneuvered right of the taxiway centerline to increase the clearance between its wingtips and the

CRJ, the left winglet of the B747 struck the left stabilizer of the CRJ. At the point of contact, the B747 was 3.6 meters right from the taxiway centerline.

The B747 stopped after its winglet made contact with the CRJ. The CRJ reported to Macao Tower Control that they had an impact and requested to shutdown the left engine in order to perform a visual inspection. The crew of CRJ confirmed that the left winglet of the B747 struck the left stabilizer of the CRJ after the inspection. CRJ shut the aircraft down and waited for further inspection.

Runway in use was changed to runway 16 while the Taxiways C2 and D were being blocked.

After the separation of aircraft, both aircraft were able to taxi back to apron where the damages were inspected.

The B747 sustained damage to its left winglet. The Minimum Equipment List (MEL) of the B747 permits flight with one winglet removed. The B747 departed at 1051UTC on the same day.

The CRJ sustained damage to its left stabilizer. Further inspection was performed by CR Airways' maintenance personnel after the occurrence. A temporary repair was carried out and the CRJ positioned back to Hong Kong at 0751 UTC on 19 September 2005.

## 1.2 Injuries to persons

### B747

	Fatal	Serious	Minor	None	Unknown
Crew	0	0	0	17	0
Passengers	0	0	0	386	0
On ground	-	-	-	-	-

### CRJ

	Fatal	Serious	Minor	None	Unknown
Crew	0	0	0	4	0
Passengers	-	-	-	-	-
On ground	-	-	-	-	-

## 1.3 Damage to Aircraft

### B747-400

Damage to B747 was limited to left winglet. Winglet leading edge was found with skin crack and twist. Leading edge joint strap and ribs were found deformed and cracked.

The Minimum Equipment List (MEL) of the B747 permits flight with one winglet removed. The B747 departed at 1051UTC on the same day.

## **CRJ-700**

The CRJ sustained damage to its left stabilizer. Further inspection was performed by CR Airways' maintenance personnel after the occurrence.

The following damage was observed on CRJ-700:

- The left horizontal stabilizer tip forward fairing was deformed at the forward and lower side; the fairing mounting straps were found broken and cracked at the forward and outboard of the fairing;
- The left horizontal stabilizer lower skin was found scratched;
- The leading edge of left stabilizer has been scratched and dented with outline about 2.5" X 14", the maximum depth is 3/8"; and
- The left horizontal stabilizer leading edge rib No. 20 was found cracked.

A temporary repair was carried out in Macau International Airport and the CRJ-700 positioned back to Hong Kong at 0751 UTC on 19 September 2005.

## **1.4 Personal Information**

### **1.4.1 B747-400**

1.4.1.1 Pilot-in-Command : Male, aged 57 (Training Captain)

License : Taiwan, China ATPL(A)

Medical : Class One  
Date of Exam 20 Apr 2005  
Valid till 31 Oct 2005

1.4.1.2 Co-Pilot : Male, aged 40 (Under I.O.E.)

License : Taiwan, China ATPL(A)

Medical : Class One  
Date of Exam 17 Mar 2005  
Valid till 30 Sep 2005

### **1.4.2 CRJ-700**

1.4.2.1 Pilot-in-Command : Male, aged 36 (Training Captain)

License : Hong Kong, China ATPL(A)

Medical : Class One  
Date of Exam 12 May 2005  
Valid till 30 Nov 2005

1.4.2.2	Co-pilot	:	Male, aged 36 (Trainee)
	License	:	Hong Kong, China Certificate of Validation of Transport Canada ATPL(A)
	Medical	:	Class One Date of Exam      06 Sep 2005 Valid till          31 Aug 2006

## 1.5 Aircraft Information

Manufacturer	The Boeing Company
Model	B747-45E
Registration	B-16402
State of registry	China (Taiwan)
Operator's Name	EVA Airways Corporation
Engine Type:	4 x CF6-80C2-B1F

Manufacturer	Bombardier Inc.
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Registration	B-KBB
State of registry	China (Hong Kong)
Operator's Name	CR Airways Limited
Engine Type:	2 x GE CF34-8C1



## **1.6 Meteorological Information**

On the day of the incident, Macau International Airport was under visual meteorological conditions. Close to the time of the incident the weather was summarized as follows:-

Surface Wind	: 070° – 03 kt
Visibility	: over 10 km
Cloud	: few cloud base at 1500 feet
Temperature	: 31 °C
QNH	: 1010 hectopascals

## **1.7 ATC and Communications**

The incident took place at Macau International Airport when both subject aircraft were with Macau Tower Frequency 118.00MHZ.

As the CRJ requested the Delta intersection departure, Macao Tower Control approved the request and the CRJ held short of runway 34 at intersection Delta as approved.

Prior to the occurrence, the B747 was taxiing on Taxiway C2 and reported ready for departure. Macao Tower Control asked the B747 if it can pass behind the CRJ for departure. After the B747 replied “affirm”, Macao Tower Control acknowledged the reply and cleared the B747 to line up RWY34 and wait.

## 1.8 Aerodrome Information

The characteristics of the taxiways where the incident occurred are as follows:-

### Taxiway C2

Width	:	23 meters
Surface	:	Concrete
Strength	:	PCN 66/R/B/W/T

### Taxiway D

Width	:	25 meters
Surface	:	Concrete
Strength	:	PCN 66/R/B/W/T

From the marking of the holding position at Taxiway D to the centerline of Taxiway C2 is 63 meters.

## **2 Analysis**

### **2.1 CRJ held short position**

After the occurrence, both subject aircraft was held the position as when the collision occurred.

After the ATC approved the CRJ to depart via intersection D and instructed the CRJ short runway 34, the CRJ has held short at intersection D in front of the stop bar. (See Figure 1 & 2).

### **2.2 B747 Taxi**

Taxi clearance was given to the B747 to hold short runway 34. Prior to the event, the crew had completed their before take-off procedures and checklist. Macau Tower gave the take-off clearance and confirmed with the B747 crew if it can pass behind the CRJ (which held short at intersection D). After the affirmative reply from B747, Tower revised the clearance to line up runway and wait. At this point, the co-pilot has prompted the PIC if he was sure that they can pass behind since the co-pilot was new type rated on the B747. The PIC of the B747 replied affirm. While the B747 was approaching to Intersection D, it was slow down and deviated to the right of the taxiway centerline in order to pass behind the CRJ. The PIC of the B747 made his judgment based on using the CRJ tail cone instead of using the CRJ horizontal stabilizer as his visual cue. At the point that the B747's PIC looked at his winglet, he found

that it was touching the CRJ horizontal stabilizer and stopped the B747 immediately with parking brake set.

At the point of contact, the B747 was 3.6 meters right from the taxiway centerline. (See Figure 3 to 5)

## 2.3 Crew Qualification

All pilots (both B747 and CRJ) were properly qualified and licensed to operate the B747 and CRJ respectively.

The route and airport (Macau International Airport) experience in last 12 months for the B747's PIC and co-pilot of the schedule operator was 9 time (last on 14 September 2005) and 2 times (last on 27 Aug 2005).

The last CRM training of the B747's PIC and co-pilot were 28 Jul 2005 and 10 Jun 2005 respectively.

Flight Time Records of the B747 crew were:

	PIC	Co-pilot
Total in Last 28 days	56:32 hours	91:06 hours
Total in Last 7 days	9:15 hours	30:15 hours
Date of occurrence (16 Sep 2005)	1:45 hours	1:45 hours

The co-pilot of the B747 is newly employed by the operator and he was under his Initial Operations Experience Training after his completed his full flight check on 24 Jul 2005.

### **3 Conclusion**

The misjudgment of spatial clearance by the taxiing B747 caused this incident. The PIC of the B747 made his judgment based on using the CRJ tail cone instead of using the CRJ horizontal stabilizer as his visual cue.

Even the intention of the B747 taxi deviation from the taxiway centerline in this incident was to give more space for avoiding the collision; it can cause other hazard by not following the taxiway centerline, especially in large aircraft.

The taxiing aircraft shall ensure that sufficient clearance can be maintained from the stationary aircraft, especially was prompted by ATC.

#### **Safety Recommendations**

Therefore, the following Safety Recommendations are made:

##### **Safety Recommendation 2006-01**

There is a procedural error that the taxiing aircraft deviating from the taxiway centerline. It is recommended that the operator of the B747 to strengthen the training on the standards operations procedures on taxiing including threat and error management.

##### **Safety Recommendation 2006-02**

Even the Air Traffic Controller has prompted the taxiing aircraft regarding the stationary aircraft in intersection D, however, it is recommended that the Air Traffic Services provider to review her current taxiing procedures applicable to the Holding Areas for departing aircraft to ensure that adequate wingtip clearance can be maintained between the hold short aircraft and maneuvering aircraft behind.



Figure 1. CRJ hold short position at intersection D (Side View)



Figure 2. CRJ hold short position at intersection D (Front View)



Figure 3. B747 stopped position after the impact. (Main Landing Gear)



Figure 4. B747 stopped position after the impact. (Nose Wheel)





Figure 5. B747 stopped position after the impact. (Front View)



Figure 6. The impact.





Figure 7. The impact.



Figure 8. Graze on the left horizontal stabilizer of B-KBB.



Figure 9. The damage to the left winglet leading edge of B-16402



Figure 10. Removed left winglet from B-16402



Figure 11. The damage to the left winglet of B-16402

**Time (UTC)      Call sign      Message**

(CRK9301 had some visual circuits within Macao ATZ and made a full stop. Call sign changed to CRK9302 for departure to Hong Kong International Airport.)

05:14:20	CRK9302	Macao Tower, CRK9302 with you. Taxi to hold short RWY34.
05:14:26	Tower	CRK9302. Good afternoon again, continue taxi.
05:14:32	CRK9302	Continue taxiing, we got to need a couple of minutes. We'd like taxiway "Delta" if possible.
05:14:36	Tower	CRK9302, that's approved. Hold short of RWY34 at "Delta". Advise when you are ready.
05:14:40	CRK9302	Hold short of 34 and advise when ready, CRK9302.
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05:19:48	Tower	CRK9302 ATC Clearance available.
05:19:51	CRK9302	Go ahead the clearance, CRK9301.
05:19:56	Tower	CRK9302 clear to Hong Kong via flight planned route at CONGA1T departure, Zhuhai QNH 1011, Squawk 5202 and your approved departure time 0530.
05:20:10	CRK9302	Track to CLK flight planned route, CONGA1T Squawk 101..Squawking 5202, QNH1011, and departure time 0530, CRK9302.
05:20:22	Tower	CRK9302 read back correct.
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05:28:14	Tower	EVA802 ..er.. can you line up RWY34. er.. are you able to pass the aircraft.
05:28:29	EVA802	Affirm. EVA802.
05:28:32	Tower	Copy, you can pass the aircraft. And line up RWY34 and wait.
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05:29:20	Tower	EVA802, wind 070 3 knots cleared for take off RWY34.
05:29:27	EVA802	EVA802 Stopping.
05:29:30	CRK9302	CRK9302 We are just in impact.
05:29:33	Tower	CRK9302 say again
05:29:36	CRK9302	I believe EVA is just touched our tail with his wing tip.
05:29:46	Tower	Roger standby.

## Transcript

## Appendix B

05:29:48 EVA802 We are sorry EVA802. Sorry about that.

05:29:51 Tower EVA802 hold short of RWY34.

05:29:54 EVA802 Affirm EVA802 is holding short.

05:30:15 CRK9302 Tower CRK9302 we are going to shut down No.1 engine and have somebody to go out to have a look the tail of the aircraft, OK?

05:30:24 Tower CRK9302 copy, please standby. I will call you back.

05:30:30 CRK9302 Listening and behaving CRK9302.

05:30:32 Tower Roger.

05:30:50 EVA802 Tower, EVA802 we need inspection before moving aircraft, right?

05:30:58 Tower EVA802, copy that. Now hold short of RWY34 and confirm you will request to return to apron or not?

05:31:06 EVA802 Not at the moment, we are going.. we need to separate both of our aircraft. My wing tip contacted with the elevator.

05:31:17 Tower Your transmission broken. Can you say again?

05:31:20 EVA802 I think our aircraft is contacted .. the wing tip with the elevator.

05:31:27 CRK9302 Macao Tower CRK9302 with you. We had taken a visual inspection, the EVA aircraft left wing tip is touching our elevator as we speak and we are unable to move. From our inspector to come out to take a close look.

05:31:44 Tower CRK9302 copy that and confirm you will be requesting return to apron for the inspection?

05:31:50 CRK9302 We are going to need to return to apron, but we need to take a closer look at our tail of plane to see what is the best course of action to move the aircraft departing currently still in contact.

05:32:00 Tower Roger. For your information, we are sending a Follow-me car for inspection as well.

05:32:04 CRK9302 Roger. We are going to shut down engine at this point. We are told .. I have been told the aircraft actually interlace the winglet of the EVA aircraft with our vertical and horizontal slat.

05:32:16 Tower Roger.

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05:33:32 CRK9302 EVA aircraft, this is CRK9302

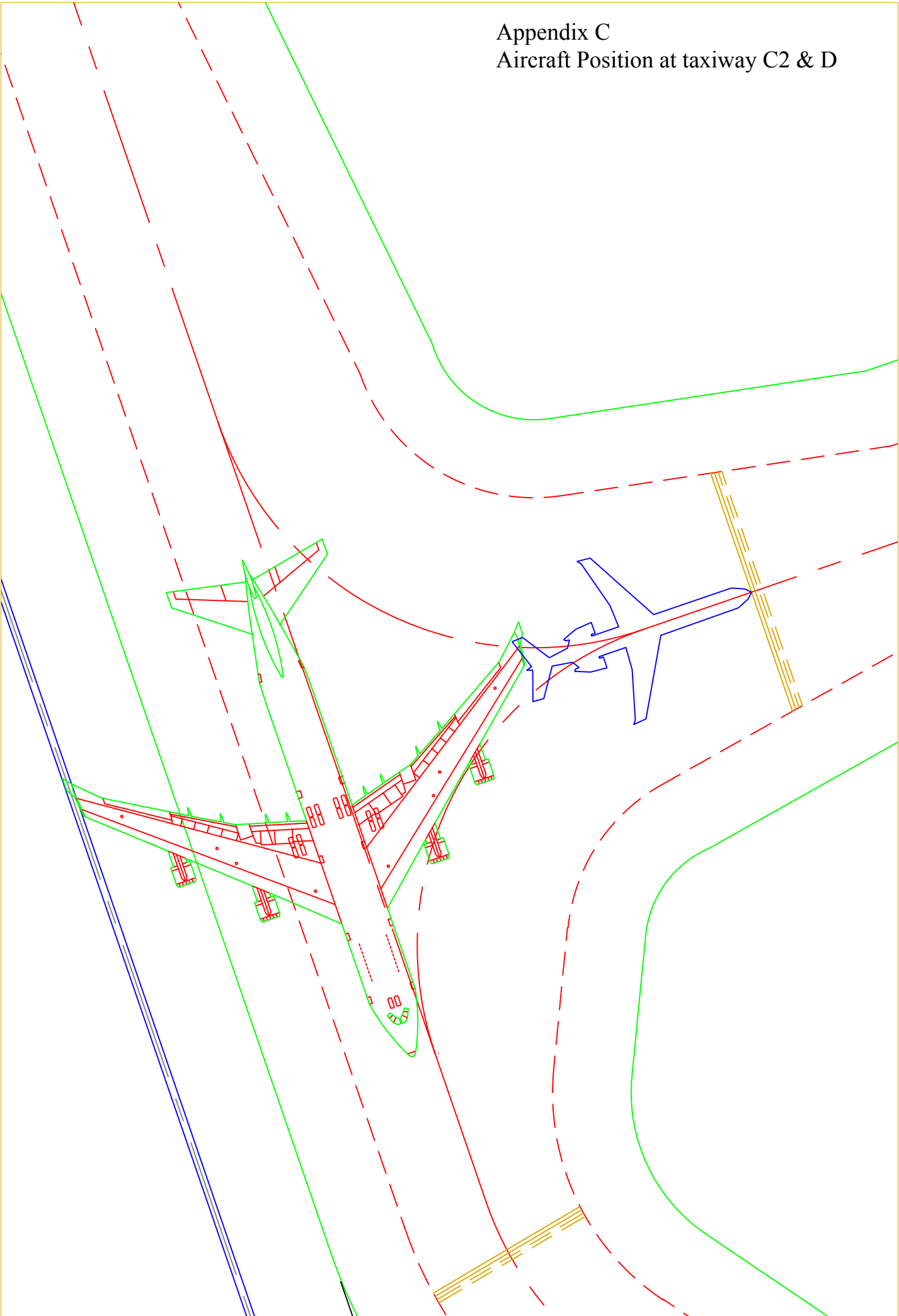
## Transcript

05:33:37      Tower      CRK9302, go ahead.  
05:33:39      CRK9302    12345  
05:33:44      Tower      CRK9302 say again  
05:33:45      CRK9302    Disregard.

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## Appendix B

Appendix C  
Aircraft Position at taxiway C2 & D





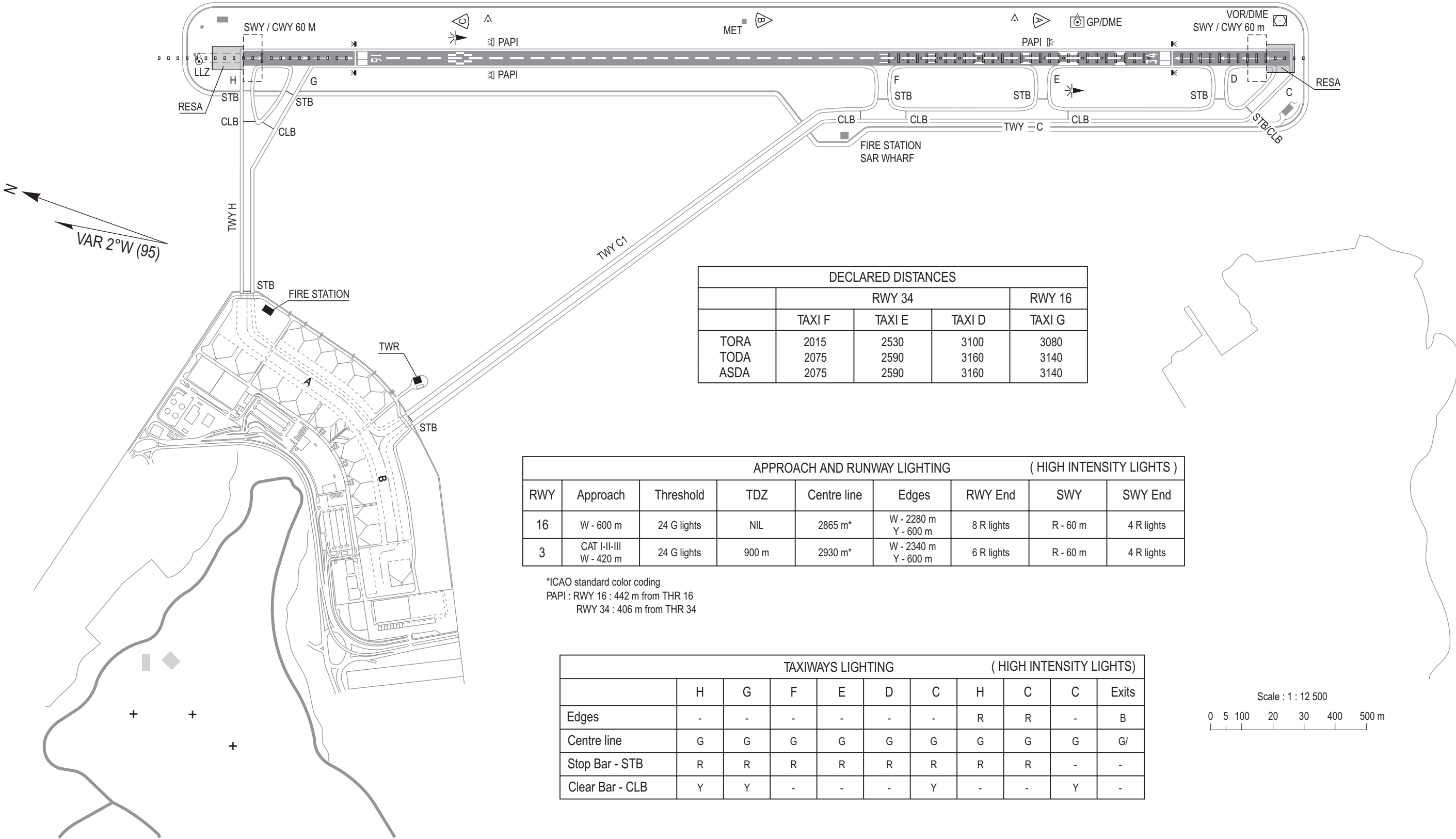
AERODROME CHART-ICAO

08 APR 99

ELEVATIONS IN FEET AMSL  
DIMENSIONS IN METRES  
BEARINGS ARE MAGNETIC

ELEV

LOW VISIBILITY OPERATION MINIMUM FOR TAKE-OFF = 175 METRES



DECLARED DISTANCES				
	RWY 34			RWY 16
	TAXI F	TAXI E	TAXI D	TAXI G
TORA	2015	2530	3100	3080
TODA	2075	2590	3160	3140
ASDA	2075	2590	3160	3140

APPROACH AND RUNWAY LIGHTING ( HIGH INTENSITY LIGHTS )								
RWY	Approach	Threshold	TDZ	Centre line	Edges	RWY End	SWY	SWY End
16	W - 600 m	24 G lights	NIL	2865 m*	W - 2280 m Y - 600 m	8 R lights	R - 60 m	4 R lights
3	CAT I-II-III W - 420 m	24 G lights	900 m	2930 m*	W - 2340 m Y - 600 m	6 R lights	R - 60 m	4 R lights

\*ICAO standard color coding  
PAPI : RWY 16 : 442 m from THR 16  
RWY 34 : 406 m from THR 34

TAXIWAYS LIGHTING ( HIGH INTENSITY LIGHTS )										
	H	G	F	E	D	C	H	C	C	Exits
Edges	-	-	-	-	-	-	R	R	-	B
Centre line	G	G	G	G	G	G	G	G	G	G/
Stop Bar - STB	R	R	R	R	R	R	R	R	-	-
Clear Bar - CLB	Y	Y	-	-	-	Y	-	-	Y	-