Telephone: (65) 6595 6051
AFS: WSSSYNYX
Facsimile: (65) 6543 1826
caas_singaporeais@caas.gov.sg
www.caas.gov.sg

REPUBLIC OF SINGAPORE
AERONAUTICAL INFORMATION SERVICES
CIVIL AVIATION AUTHORITY OF SINGAPORE
SINGAPORE CHANGI AIRPORT
P.O. BOX 1, SINGAPORE 918141

AIP SUPPLEMENT

AIRAC
173/11
8TH SEPTEMBER

CONTINUOUS DESCENT OPERATION (CDO) FOR ARRIVALS INTO SINGAPORE CHANGI AIRPORT

1 INTRODUCTION

1.1 As part of CAAS's ongoing efforts to improve operational efficiency and air traffic management, a Continuous Descent Operation (CDO) trial will be conducted from 0000UTC on 17 November 2011 until 2359UTC on 16 February 2012 prior to implementation. CDO is an aircraft operating technique which enables the pilot to execute an optimised arrival descend profile utilising the onboard capability of the aircraft. CDO is facilitated by appropriate instrument flight procedure design and air traffic control (ATC) procedures.

1.2 The vertical profile of CDO takes the form of a continuously descending path with minimum level flight segments to enable smooth aircraft deceleration and configuration prior to an ILS approach. New CDO RNAV STARs have been constructed in accordance to ICAO Document 9931 CDO Manual and ICAO Document 8168 Procedures for Air Navigation, Aircraft Operations, to facilitate the CDO trial into Singapore Changi Airport.

2. CDO RNAV STANDARD INSTRUMENT ARRIVALS

2.1 The new CDO RNAV STARs are:

For Arrivals on Runway 02L (Refer to **Attachment 1**)
i) BOBAG ONE KILO (BOBAG 1K) for arrivals on Runway 02L,
ii) PASPU ONE KILO (PASPU 1K) for arrivals on Runway 02L,
iii) REMES ONE KILO (REMES 1K) for arrivals on Runway 02L,
iv) LAVAX ONE KILO (LAVAX 1K) for arrivals on Runway 02L.

For Arrivals on Runway 20R (Refer to **Attachment 2**)
i) BOBAG ONE LIMA (BOBAG 1L) for arrivals on Runway 20R,
ii) PASPU ONE LIMA (PASPU 1L) for arrivals on Runway 20R,
iii) REMES ONE LIMA (REMES 1L) for arrivals on Runway 20R,
iv) LAVAX ONE LIMA (LAVAX 1L) for arrivals on Runway 20R.

2.2 The CDO RNAV STARs into Singapore Changi Airport are designed for arrivals on Runways 02L and 20R. The lateral flight track is pre-defined up to and including the FAF and thus the distance to runway is known. These are closed path designs which permit distance planning, allowing the aircraft Flight Management System/Computer (FMS/FMC) to accurately execute automated optimized descents.

2.3 Where air traffic permits, CDO arrivals will be available for flights arriving into Singapore Changi Airport on Runways 02L and 20R. ATC may suspend or cancel the CDO due to traffic conditions even after CDO is cleared. Alternate ATC instructions will be issued when CDO is suspended or cancelled.

2.4 Detailed flight crew instructions including radio telephony phraseologies relating to CDO can be found in **Attachment 3** of this AIP Supplement.

3. PERFORMANCE BASED NAVIGATION SPECIFICATION

3.1 The CDO RNAV STARs are designated as RNAV 1 navigation specification as specified in ICAO Document 9613 Performance Based Navigation (PBN) Manual. Airline Operators shall refer to the ICAO PBN Manual for requirements on RNAV 1 operational approval.

3.2 In the event that airborne RNAV equipment fails, pilot shall inform ATC as soon as practicable. ATC shall then terminate CDO operation and resume with radar vectors to aid pilot in landing into Singapore Changi Airport.

4. IMPLEMENTATION OF CDO FOR ARRIVALS ON RUNWAY 02L/20R AT SINGAPORE CHANGI AIRPORT

4.1 CDO for arrivals on Runway 02L/20R at Singapore Changi Airport will be implemented with effect from 0000UTC on 17 February 2012.

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

SINGAPORE/Singapore Changi
RWY 02L
BOBAG ONE KILO ARRIVAL
BOBAG 1K
RNAV(GNSS) CDO

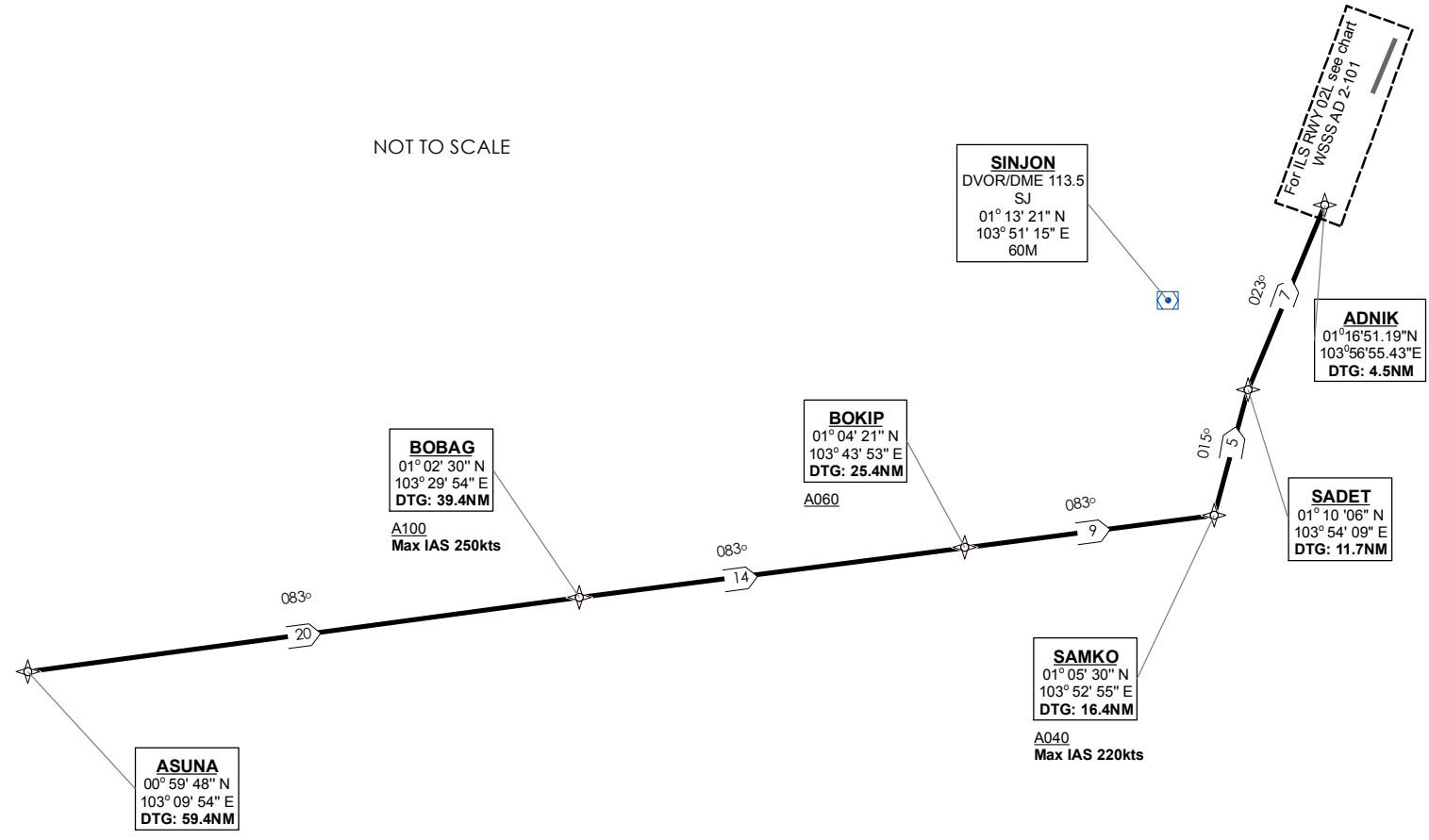
ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
VAR 27'E (2010)

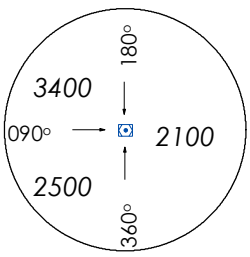
DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE

NOT TO SCALE





MSA 25nm
from **SINJON** DVOR

BOBAG 1K (RWY 02L) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description	Abbreviated Description	Expected Path Terminator	Flyover required
To ASUNA	ASUNA	TF	-
To BOBAG at A100 minimum; IAS 250kts maximum	BOBAG[A100+]; K250-	TF	-
To BOKIP at A060 minimum	BOKIP[A060+]	TF	-
To SAMKO at A040 minimum; IAS 220kts maximum	SAMKO[A040+]; K220-	TF	-
To SADET	SADET	TF	-
To ADNIK	ADNIK	TF	-

Tabular Description

Path Term	Waypoint Name	Flyover	Course ^{0}M (^{0}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	ASUNA	-	083(082.5)	-	-	-	-0.5	-	RNAV1
TF	BOBAG	-	083(082.5)	-	A100+	K250-	-0.5	-	RNAV1
TF	BOKIP	-	083(082.5)	-	A060+	-	-0.5	-	RNAV1
TF	SAMKO	-	015(014.5)	L	A040+	K220-	-0.5	-	RNAV1
TF	SADET	-	022(21.5)	R	-	-	-0.5	-	RNAV1
TF	ADNIK	-	022(21.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via BOBAG 1K by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on BOBAG 1K to ADNIK **(b)** From ADNIK commence descent and carry out appropriate landing procedure for RWY 02L as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

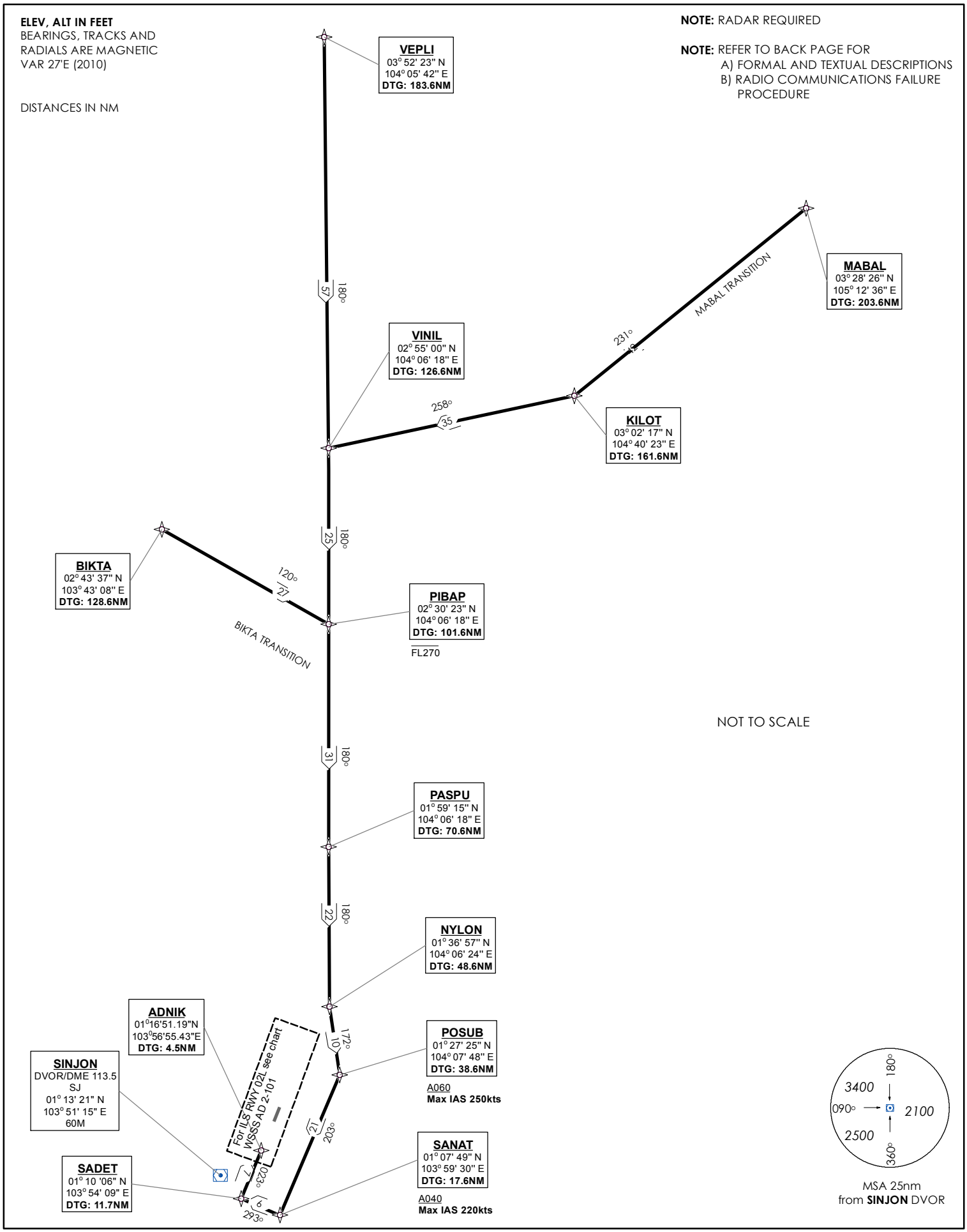
SINGAPORE/Singapore Changi
RWY 02L
PASPU ONE KILO ARRIVAL
PASPU 1K
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC VAR 27'E (2010)

DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE



MSA 25nm
from **SINJON** DVOR

PASPU 1K (RWY 02L) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description (transition BIKTA)	Abbreviated Description	Expected Path Terminator	Flyover required
To BIKTA	BIKTA	TF	-
To PIBAP at FL270 maximum	PIBAP[FL270-]	TF	-
Refer to PASPU 1K for descriptions			
Formal Description (transition VEPLI)			
To VEPLI	VEPLI	TF	-
To VINIL	VINIL	TF	-
To PIBAP at FL270 maximum	PIBAP[FL270-]	TF	-
Refer to PASPU 1K for descriptions			
Formal Description (transition MABAL)			
To MABAL	MABAL	TF	-
To KILOT	KILOT	TF	-
To VINIL	VINIL	TF	-
To PIBAP at FL270 maximum	PIBAP[FL270-]	TF	-
Refer to PASPU 1K for descriptions			
Formal Description (PASPU 1K)			
To PASPU	PASPU	TF	-
To NYLON	NYLON	TF	-
To POSUB at A060 minimum; IAS 250kts maximum	POSUB[A060+]; K250-	TF	-
To SANAT at A040 minimum, IAS 220kts maximum	SANAT[A040+]; K220-	TF	-
To SADET	SADET	TF	-
To ADNIK	ADNIK	TF	-

Tabular Description (BIKTA transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	BIKTA	-	120(119.5)	-	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	-	FL270-	-	-0.5	-	RNAV1
Refer to PASPU 1K for descriptions									

Tabular Description (VEPLI transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	VEPLI	-	180(179.5)	-	--	-	-0.5	-	RNAV1
TF	VINIL	-	180(179.5)	-	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	-	FL270-	-	-0.5	-	RNAV1
Refer to PASPU 1K for descriptions									

Tabular Description (MABAL transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	MABAL	-	231(230.5)	-	-	-	-0.5	-	RNAV1
TF	KILOT	-	258(257.5)	R	-	-	-0.5	-	RNAV1
TF	VINIL	-	180(179.5)	L	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	-	FL270-	-	-0.5	-	RNAV1
Refer to PASPU 1K for descriptions									

Tabular Description (PASPU 1K)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	PASPU	-	180(179.5)	-	-	-	-0.5	-	RNAV1
TF	NYLON	-	172(171.5)	L	-	-	-0.5	-	RNAV1
TF	POSUB	-	203(202.5)	R	A060+	K250-	-0.5	-	RNAV1
TF	SANAT	-	293(292.5)	R	A040+	K220-	-0.5	-	RNAV1
TF	SADET	-	023(022.5)	R	-	-	-0.5	-	RNAV1
TF	ADNIK	-	023(022.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via PASPU 1K by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on PASPU 1K to ADNIK **(b)** From ADNIK commence descent and carry out appropriate landing procedure for RWY 02L as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

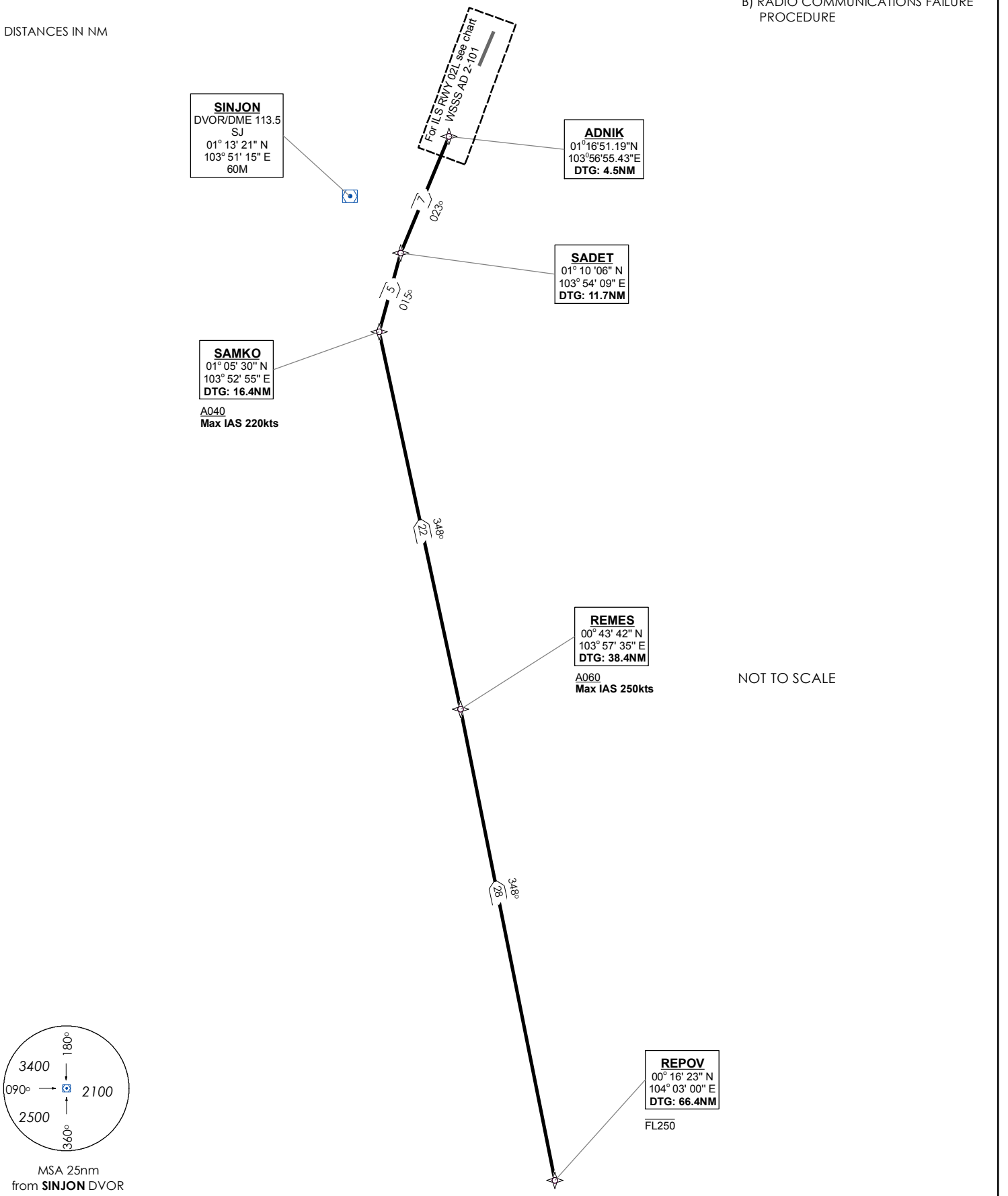
SINGAPORE/Singapore Changi
RWY 02L
REMES ONE KILO ARRIVAL
REMES 1K
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC VAR 27'E (2010)

DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE



REMES 1K (RWY 02L) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description	Abbreviated Description	Expected Path Terminator	Flyover required
To REPOV at FL250 maximum	REPOV[FL250-]	TF	-
To REMES at A060 minimum; IAS 250kts maximum	REMES[A060+]; K250-	TF	-
To SAMKO at A040 minimum; IAS 220kts maximum	SAMKO[A040+]; K220-	TF	-
To SADET	SADET	TF	-
To ADNIK	ADNIK	TF	-

Tabular Description

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	REPOV	-	348(347.5)	-	FL250-	-	-0.5	-	RNAV1
TF	REMES	-	348(347.5)	-	A060+	K250-	-0.5	-	RNAV1
TF	SAMKO	-	015(014.5)	R	A040+	K220-	-0.5	-	RNAV1
TF	SADET	-	022(021.5)	R	-	-	-0.5	-	RNAV1
TF	ADNIK	-	022(021.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via REMES 1K by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on REMES 1K to ADNIK **(b)** From ADNIK commence descent and carry out appropriate landing procedure for RWY 02L as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO

STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

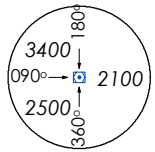
SINGAPORE/Singapore Changi
RWY 02L
LAVAX ONE KILO ARRIVAL
LAVAX 1K
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
VAR 27°E (2010)

DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE



MSA 25nm
from **SINJON** DVOR

SINJON
DVOR/DME 113.5
SJ
01° 13' 21" N
103° 51' 15" E
60M

For ILS RWY 02L see chart WSSS AD 2.-101

ADNIK
01°16'51.19"N
103°56'55.43"E
DTG: 4.5NM

IGNON
01° 08' 47" N
104° 12' 57" E
DTG: 31.5NM
A070

LAVAX
01° 09' 50" N
104° 27' 14" E
DTG: 47.2NM
FL140
Max IAS 250kts

KEXAS
01° 10' 19" N
104° 48' 18" E
DTG: 68.2NM

KARTO
01° 11' 24" N
105° 33' 43" E
DTG: 114.2NM

TOMAN
01° 21' 47" N
105° 47' 17" E
DTG: 131.2NM

TOMAN TRANSITION

SADET
01° 10 '06" N
103° 54' 09" E
DTG: 11.7NM

SANAT
01° 07' 49" N
103° 59' 30" E
DTG: 17.6NM
A040
Max IAS 220kts

IBULA
00° 50' 36" N
104° 36' 00" E
DTG: 68.2NM

IKIMA
00° 43' 14" N
104° 55' 00" E
DTG: 88.2NM

ATVIX
00° 02' 24" N
106° 14' 53" E
DTG: 178.2NM

AKTOD
01° 35' 13" S
105° 59' 34" E
DTG: 182.2NM

GOBIK
00° 00' 00" N
108° 06' 06" E
DTG: 283.2NM

ATVIX TRANSITION

AKTOD TRANSITION

GOBIK TRANSITION

NOT TO SCALE

LAVAX 1K (RWY 02L) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description (transition ATVIX)	Abbreviated Description	Expected Path Terminator	Flyover required
To ATVIX	ATVIX	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1K descriptions			
Formal Description (transition AKTOD)			
To AKTOD	AKTOD	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1K descriptions			
Formal Description (transition GOBIK)			
To GOBIK	GOBIK	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1K descriptions			
Formal Description (transition TOMAN)			
To TOMAN	TOMAN	TF	-
To KARTO	KARTO	TF	-
To KEXAS	KEXAS	TF	-
Please refer to LAVAX 1K descriptions			
Formal Description (LAVAX 1K)			
To LAVAX at FL140 maximum; IAS 250kts maximum	LAVAX[FL140-]; K250-	TF	-
To IGNON at A070 minimum	IGNON[A070+]	TF	-
To SANAT at A040 minimum; IAS 220kts maximum	SANAT[A040+]; K220-	TF	-
To SADET	SADET	TF	-
To ADNIK	ADNIK	TF	-

Tabular Description (ATVIX transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	ATVIX	-	297(296.5)	-	-	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	L	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1K descriptions									

Tabular Description (AKTOD transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	AKTOD	-	316(315.5)	-	--	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	L	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1K descriptions									

Tabular Description (GOBIK transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	GOBIK	-	283(282.5)	-	-	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	R	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1K descriptions									

Tabular Description (TOMAN transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	TOMAN	-	233(232.5)	-	-	-	-0.5	-	RNAV1
TF	KARTO	-	269(268.5)	R	-	-	-0.5	-	RNAV1
TF	KEXAS	-	269(268.5)	L	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1K descriptions									

Tabular Description (LAVAX 1K)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	LAVAX	-	266(265.5)	-	FL140-	K250-	-0.5	-	RNAV1
TF	IGNON	-	266(265.5)	-	A070+	-	-0.5	-	RNAV1
TF	SANAT	-	293(292.5)	R	A040+	K220-	-0.5	-	RNAV1
TF	SADET	-	023(022.5)	R	--	-	-0.5	-	RNAV1
TF	ADNIK	-	023(022.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via LAVAX 1K by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on LAVAX 1K to ADNIK **(b)** From ADNIK commence descent and carry out appropriate landing procedure for RWY 02L as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

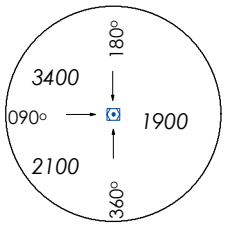
TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

SINGAPORE/Singapore Changi
RWY 20R
BOBAG ONE LIMA ARRIVAL
BOBAG 1L
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
VAR 27'E (2010)

DISTANCES IN NM

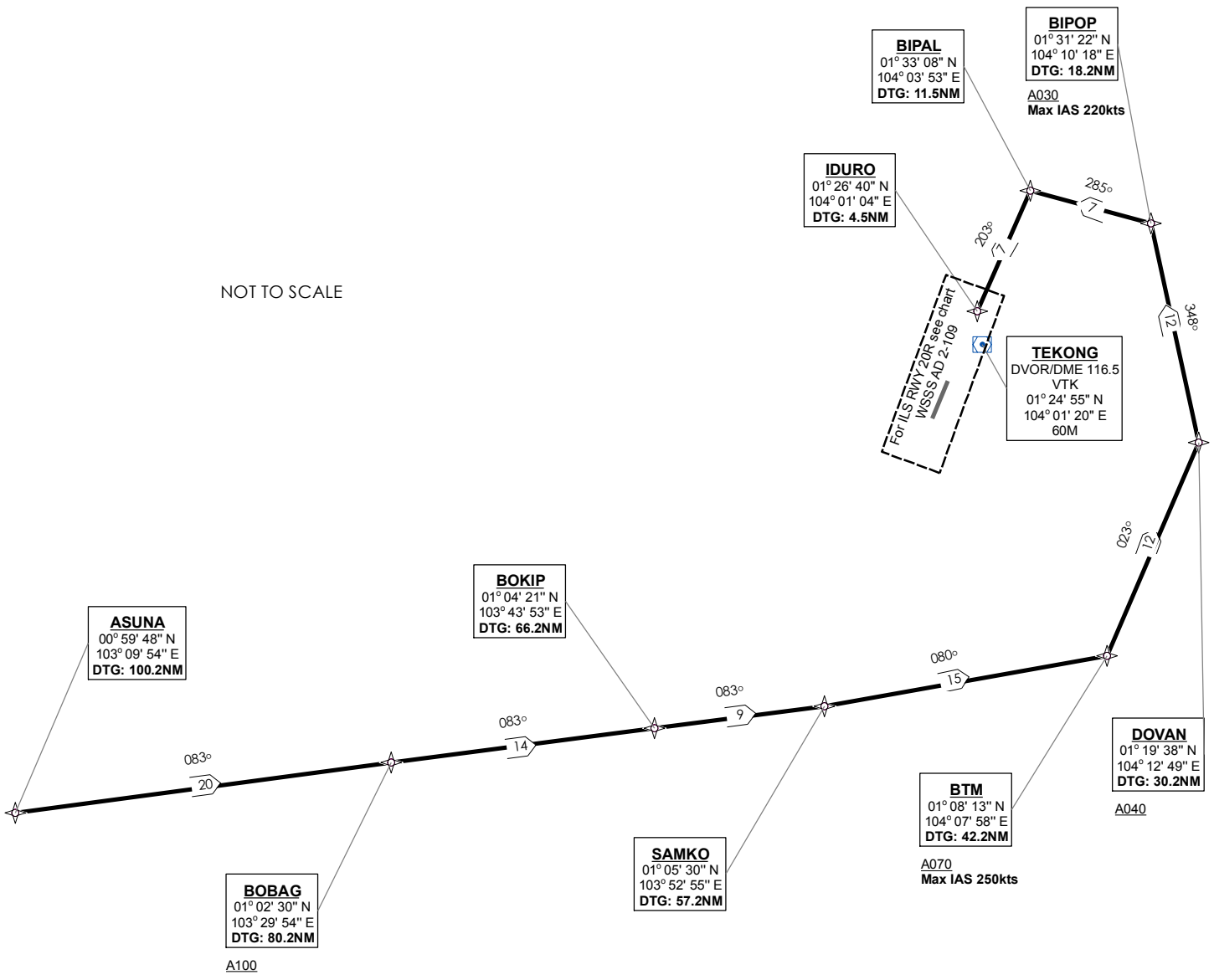


MSA 25nm
from **TEKONG** DVOR

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE

NOT TO SCALE



BOBAG 1L (RWY 20R) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description	Abbreviated Description	Expected Path Terminator	Flyover required
To ASUNA	ASUNA	TF	-
To BOBAG at A100 minimum	BOBAG[A100+]	TF	-
To BOKIP	BOKIP	TF	-
To SAMKO	SAMKO	TF	-
To BTM at A070 minimum; IAS 250kts maximum	BTM[A070+]; K250-	TF	-
To DOVAN at A040 minimum	DOVAN[A040+]	TF	-
To BIPOP at A030 minimum; IAS 220kts maximum	BIPOP[A030+]; K220-	TF	-
To BIPAL	BIPAL	TF	-
To IDURO	IDURO	TF	-

Tabular Description

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	ASUNA	-	083(082.5)	-	-	-	-0.5	-	RNAV1
TF	BOBAG	-	083(082.5)	-	A100+	-	-0.5	-	RNAV1
TF	BOKIP	-	083(082.5)	-	-	-	-0.5	-	RNAV1
TF	SAMKO	-	080(079.5)	L	-	-	-0.5	-	RNAV1
TF	BTM	-	023(022.5)	L	A070+	K250-	-0.5	-	RNAV1
TF	DOVAN	-	348(347.5)	L	A040+	-	-0.5	-	RNAV1
TF	BIPOP	-	285(287.5)	L	A030+	K220-	-0.5	-	RNAV1
TF	BIPAL	-	203(202.5)	L	-	-	-0.5	-	RNAV1
TF	IDURO	-	203(202.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via BOBAG 1L by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on BOBAG 1L to IDURO **(b)** From IDURO commence descent and carry out appropriate landing procedure for RWY 20R as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

SINGAPORE/Singapore Changi
RWY 20R
PASPU ONE LIMA ARRIVAL
PASPU 1L
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC VAR 27'E (2010)

DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE

VEPLI
03° 52' 23" N
104° 05' 42" E
DTG: 151.1NM

57 180°

VINIL
02° 55' 00" N
104° 06' 18" E
DTG: 94.1NM

231°

MABAL TRANSITION

MABAL
03° 28' 26" N
105° 12' 36" E
DTG: 171.1NM

258°
35

KILOT
03° 02' 17" N
104° 40' 23" E
DTG: 129.1NM

BIKTA
02° 43' 37" N
103° 43' 08" E
DTG: 96.1NM

120°
21

BIKTA TRANSITION

25 180°

PIBAP
02° 30' 23" N
104° 06' 18" E
DTG: 69.1NM

FL250

NOT TO SCALE

31 180°

PASPU
01° 59' 15" N
104° 06' 18" E
DTG: 38.1NM

A060
Max IAS 250kts

22 180°

NYLON
01° 36' 57" N
104° 06' 24" E
DTG: 16.1NM

A030
Max IAS 220kts

BIPAL
01° 33' 08" N
104° 03' 53" E
DTG: 11.5NM

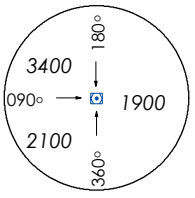
214°
5

203°
7

IDURO
01° 26' 40" N
104° 01' 04" E
DTG: 4.5NM

For ILS RWY 20R see chart WSSS AD 2-109

TEKONG
DVOR/DME 116.5
VTK
01° 24' 55" N
104° 01' 20" E
60M



MSA 25nm
from **TEKONG** DVOR

PASPU 1L (RWY 20R) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description (transition BIKTA)	Abbreviated Description	Expected Path Terminator	Flyover required
To BIKTA	BIKTA	TF	-
To PIBAP at FL250 maximum	PIBAP[FL250-]	TF	-
Refer to PASPU 1L for descriptions			
Formal Description (transition VEPLI)			
To VEPLI	VEPLI	TF	-
To VINIL	VINIL	TF	-
To PIBAP at FL250 maximum	PIBAP[FL250-]	TF	-
Refer to PASPU 1L for descriptions			
Formal Description (transition MABAL)			
To MABAL	MABAL	TF	-
To KILOT	KILOT	TF	-
To VINIL	VINIL	TF	-
To PIBAP at FL250 maximum	PIBAP[FL250-]	TF	-
Refer to PASPU 1L for descriptions			
Formal Description (PASPU 1L)			
To PASPU at A060 minimum; IAS 250kts maximum	PASPU[A060+]; K250-	TF	-
To NYLON A030 minimum; IAS 220kts maximum	NYLON[A030+]; K220-	TF	-
To BIPAL	BIPAL	TF	-
To IDURO	IDURO	TF	-

Tabular Description (BIKTA transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	BIKTA	-	120(119.5)	-	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	R	FL250-	-	-0.5	-	RNAV1
Refer to PASPU 1L for descriptions									

Tabular Description (VEPLI transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	VEPLI	-	180(179.5)	-	--	-	-0.5	-	RNAV1
TF	VINIL	-	180(179.5)	-	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	-	FL250-	-	-0.5	-	RNAV1
Refer to PASPU 1L for descriptions									

Tabular Description (MABAL transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	MABAL	-	231(230.5)	-	-	-	-0.5	-	RNAV1
TF	KILOT	-	258(257.5)	R	-	-	-0.5	-	RNAV1
TF	VINIL	-	180(179.5)	L	-	-	-0.5	-	RNAV1
TF	PIBAP	-	180(179.5)	-	FL250-	-	-0.5	-	RNAV1
Refer to PASPU 1L for descriptions									

Tabular Description (PASPU 1L)

Path Term	Waypoint Name	Flyover	Course ^{0}M (^{0}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	PASPU	-	180(179.5)	-	A060+	K250-	-0.5	-	RNAV1
TF	NYLON	-	214(213.5)	R	A030+	K220-	-0.5	-	RNAV1
TF	BIPAL	-	203(202.5)	L	-	-	-0.5	-	RNAV1
TF	IDURO	-	203(202.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via PASPU 1L by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on PASPU 1L to IDURO **(b)** From IDURO commence descent and carry out appropriate landing procedure for RWY 20R as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

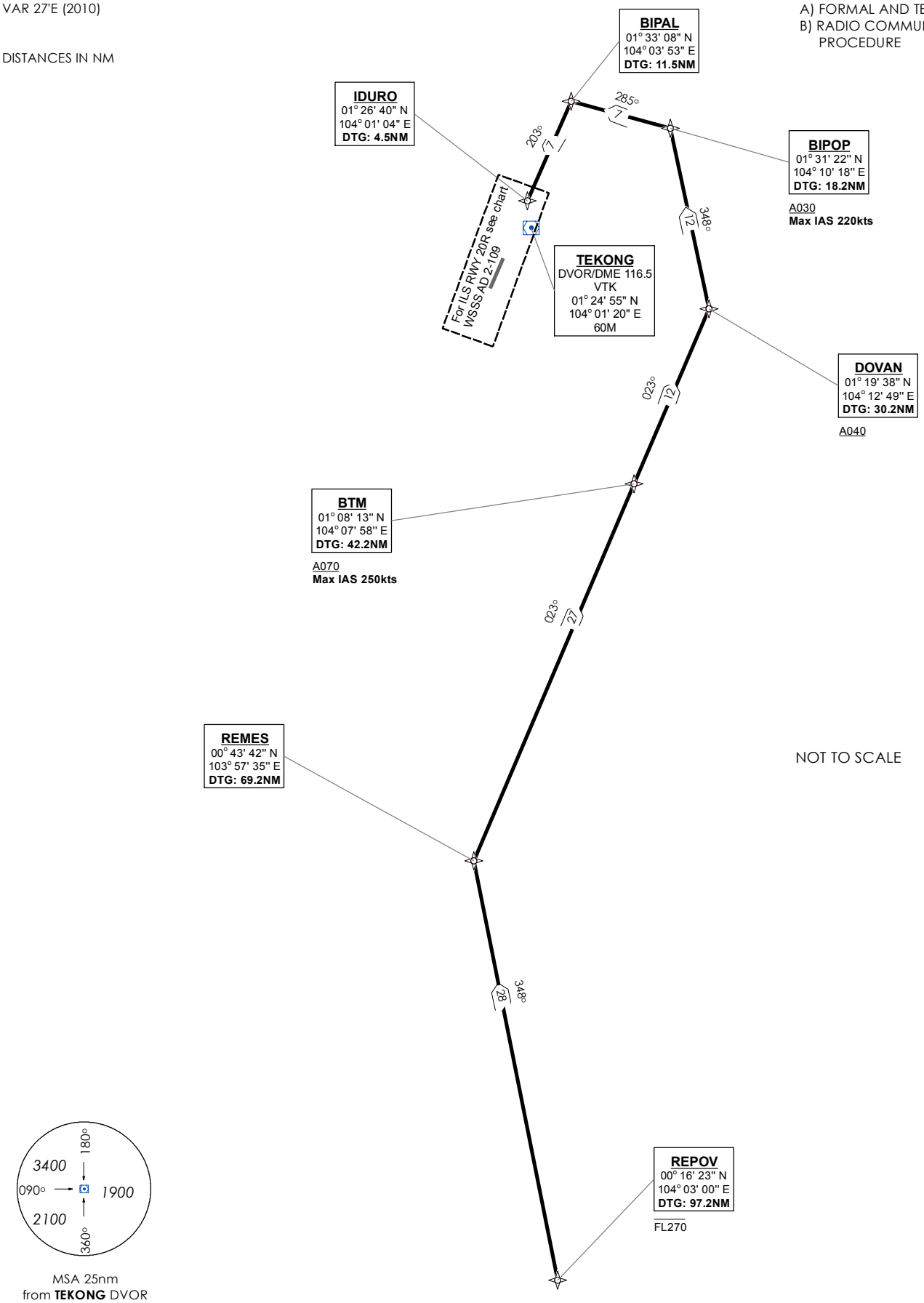
SINGAPORE/Singapore Changi
RWY 20R
REMES ONE LIMA ARRIVAL
REMES 1L
RNAV(GNSS) CDO

ELEV, ALT IN FEET
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
VAR 27'E (2010)

DISTANCES IN NM

NOTE: RADAR REQUIRED

NOTE: REFER TO BACK PAGE FOR
A) FORMAL AND TEXTUAL DESCRIPTIONS
B) RADIO COMMUNICATIONS FAILURE PROCEDURE



REMES 1L (RWY 20R) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description	Abbreviated Description	Expected Path Terminator	Flyover required
To REPOV at FL270 maximum	REPOV[FL270-]	TF	
To REMES	REMES	TF	-
To BTM at A070 minimum; IAS 250kts maximum	BTM[A070+]; K250-	TF	-
To DOVAN at A040 minimum	DOVAN[A040+]	TF	
To BIPOP at A030 minimum; IAS 220kts maximum	BIPOP[A030]; K220-	TF	-
To BIPAL	BIPAL	TF	-
To IDURO	IDURO	TF	-

Tabular Description

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	REPOV	-	348(347.5)		FL270-	-	-0.5	-	RNAV1
TF	REMES	-	023(22.5)	R	-	-	-0.5	-	RNAV1
TF	BTM	-	023(22.5)	-	A070+	K250-	-0.5	-	RNAV1
TF	DOVAN	-	348(347.5)	L	A040+	-	-0.5	-	RNAV1
TF	BIPOP	-	285(284.5)	L	A030+	K220-	-0.5	-	RNAV1
TF	BIPAL	-	203(202.5)	L	-	-	-0.5	-	RNAV1
TF	IDURO	-	203(202.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via REMES 1L by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on REMES 1L to IDURO **(b)** From IDURO commence descent and carry out appropriate landing procedure for RWY 20R as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

RNAV STAR CDO

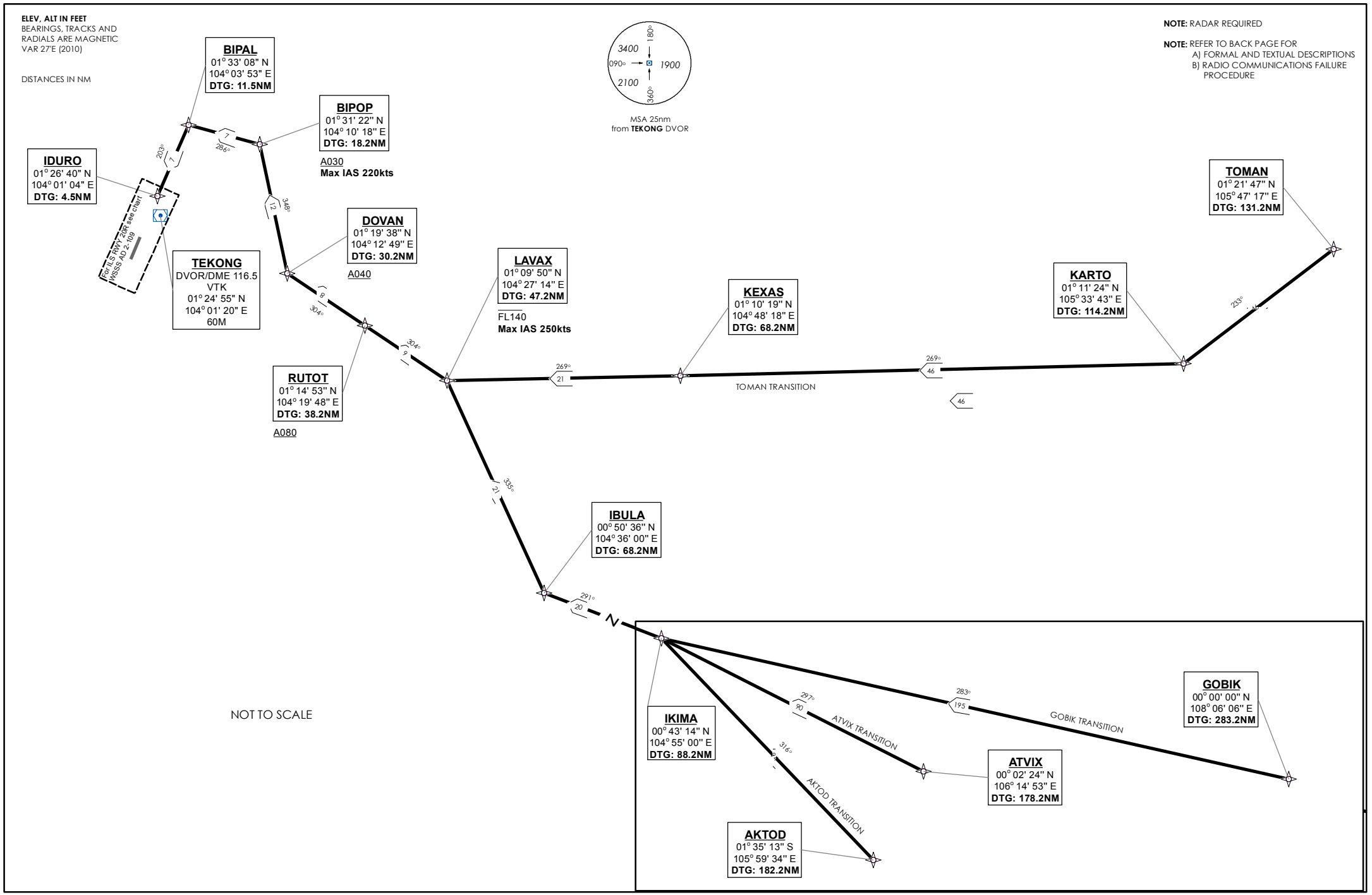
STANDARD ARRIVAL CHART - INSTRUMENT (STAR)

ACC 134.4
APP 124.05 / 120.3
ARR 119.3
TWR 118.6 / 118.25

TRANSITION ALTITUDE
11 000ft

D-ATIS AP ID-WSSS
128.6

SINGAPORE/Singapore Changi
RWY 20R
LAVAX ONE LIMA ARRIVAL
LAVAX 1L
RNAV(GNSS) CDO



LAVAX 1L (RWY 20R) CDO RNAV STAR – DESCRIPTIONS

Formal & Abbreviated Descriptions

Formal Description (transition ATVIX)	Abbreviated Description	Expected Path Terminator	Flyover required
To ATVIX	ATVIX	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1L descriptions			
Formal Description (transition AKTOD)			
To AKTOD	AKTOD	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1L descriptions			
Formal Description (transition GOBIK)			
To GOBIK	GOBIK	TF	-
To IKIMA	IKIMA	TF	-
To IBULA	IBULA	TF	-
Please refer to LAVAX 1L descriptions			
Formal Description (transition TOMAN)			
To TOMAN	TOMAN	TF	-
To KARTO	KARTO	TF	-
To KEXAS	KEXAS	TF	-
Please refer to LAVAX 1L descriptions			
Formal Description (LAVAX 1L)			
To LAVAX at, FL140 maximum; IAS 250kts maximum	LAVAX[FL140-]; K250-	TF	-
To RUTOT at A080 minimum	RUTOT[A080+]	TF	-
To DOVAN at A040 minimum	DOVAN[A040+;]	TF	-
To BIPOP at A030 minimum; IAS 220kts maximum	BIPOP[A030+]; K220-	TF	-
To BIPAL	BIPAL	TF	-
To IDURO	IDURO	TF	-

Tabular Description (ATVIX transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	ATVIX	-	297(296.5)	-	-	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	L	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1L descriptions									

Tabular Description (AKTOD transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	AKTOD	-	316(315.5)	-	--	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	L	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1L descriptions									

Tabular Description (GOBIK transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	GOBIK	-	283(282.5)	-	-	-	-0.5	-	RNAV1
TF	IKIMA	-	291(290.5)	R	-	-	-0.5	-	RNAV1
TF	IBULA	-	335(334.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1L descriptions									

Tabular Description (TOMAN transition)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	TOMAN	-	233(232.5)	-	-	-	-0.5	-	RNAV1
TF	KARTO	-	269(268.5)	R	-	-	-0.5	-	RNAV1
TF	KEXAS	-	269(268.5)	R	-	-	-0.5	-	RNAV1
Please refer to LAVAX 1L descriptions									

Tabular Description (LAVAX 1L)

Path Term	Waypoint Name	Flyover	Course ^{O}M (^{O}T)	Turn Direction	Altitude	Speed Limit	Magnetic Variation	Vertical angle	Navigation Performance
TF	LAVAX	-	304(303.5)	-	FL140-	K250-	-0.5	-	RNAV1
TF	RUTOT	-	304(303.5)	-	A080+	-	-0.5	-	RNAV1
TF	DOVAN	-	348(347.5)	R	A040+	-	-0.5	-	RNAV1
TF	BIPOP	-	286(285.5)	L	A030+	K220-	-0.5	-	RNAV1
TF	BIPAL	-	203(202.5)	L	-	-	-0.5	-	RNAV1
TF	IDURO	-	203(202.5)	-	-	-	-0.5	-	RNAV1

RADIO COMMUNICATIONS FAILURE PROCEDURE

1	**SET TRANSPONDER TO MODE A/C CODE 7600**
2	**When cleared via LAVAX 1L by Singapore ATC** **(a)** Maintain last assigned flight level or altitude and proceed on LAVAX 1L to IDURO **(b)** From IDURO commence descent and carry out appropriate landing procedure for RWY 20R as close as possible to EAT or ETA **(c)** If unable to effect a landing, refer to Singapore AIP for missed approach procedure
3	**No clearance or instruction received from Singapore ATC** - refer to Singapore AIP for radio communications failure procedure

CONTINUOUS DESCENT OPERATION (CDO) FOR ARRIVALS INTO SINGAPORE CHANGI AIRPORT

FLIGHT CREW INSTRUCTIONS

1. Introduction

1.1. This flight crew instruction outlines the conditions, requirements and the associated radio telephony phraseologies to execute the CDO procedures.

2. Conditions for conducting a CDO

2.1. Pilots shall adhere to the instructions as depicted on the CDO RNAV STARs and the conditions for ILS procedures into Changi. In addition, the following conditions must be met;

i. Changi Runway 02L / 20R is open for landing;
ii. ILS for the intended runway of landing into Changi is in operation;
iii. Visibility $\geq$ 800m;
iv. RVR $\geq$ 550m for runway-in-use; and
v. No other system degradation that may affect a GNSS or ILS operation.

3. Requirements for individual flights

3.1. Flights that fulfill the following requirements can be allowed to conduct a CDO subject to ATC and real-time traffic condition:

i. Flight enters Singapore FIR via one of the following waypoints and ATS routes:

IGARI (N891)	AGOBA (G580)
IPRIX (M753)	KIKOR (M774/A464)
ESPOB (L642)	SANOS (A576)
MELAS (N892)	PARDI (G579)
TEGID (M767)	TAROS (R469)
KAMIN (B348)	GOBIK

ii. RNAV-equipped aircraft with FMC capable of:
- LNAV and VNAV;
- flying Changi RNAV STARs and to abide by all speed and altitude restrictions depicted on the charts;
- continuing on planned vertical path from RNAV STAR onto ILS of intended runway of landing.

4. Preparations for CDO

4.1. To ensure that the CDO procedures can be effectively carried out, pilots are advised to abide by the following;

i. Check if conditions for conducting the CDO are met;
ii. Check if flight meets requirement for executing a CDO; and
iii. Plan the lateral route in your FMC as shown in **Table 1** based on FIR entry point and landing runway in use. The landing runway-in-use is available from D-ATIS (freq 128.6 MHz)

FIR entry point	RWY	STAR	Transition
ESPOB, IPRIX, IGARI	02L	PASPU 1K	VEPLI
	20R	PASPU 1L	
MELAS	02L	PASPU 1K	MABAL
	20R	PASPU 1L	
TEGID, KAMIN, AGOBA	02L	LAVAX 1K	TOMAN
	20R	LAVAX 1L	
KIKOR	02L	LAVAX 1K	ATVIX
	20R	LAVAX 1L	
SANOS	02L	LAVAX 1K	AKTOD
	20R	LAVAX 1L	
GOBIK	02L	LAVAX 1K	GOBIK
	20R	LAVAX 1L	
PARDI	02L	REMES 1K	-
	20R	REMES 1L	
TAROS	02L	BOBAG 1K	-
	20R	BOBAG 1L	

Table 1

5. CDO Execution

5.1. On first contact with Singapore Radar, use the following when requesting for a CDO:

> "Request **C-D-O**" [read as See-Dee-Oh]

- Depending on the situation, Singapore ATC will make an early assessment to approve / disapprove your request accordingly. When it is obvious to ATC that the conduct of CDO flight will not reap any operational benefit, ATC shall disapprove your request and inform you accordingly

5.2. If CDO is approved, Singapore ATC shall reply using the following phraseology:

> "[flight callsign], **expect C-D-O** [read as See-Dee-Oh] and cleared to Singapore via [STAR] Arrival, [transition, if any] transition, Runway [runway-in-use]. Maintain [cruising altitude], report ready for descent"

- On receipt of this clearance from Singapore ATC, pilot shall plan the arrival route using FMC and to report estimated time/distance for Top Of Descent (TOD) once the information is available. CDO RNAV STARs have been designed for arrivals into Runway 02L or Runway 20R and linking up to the ILS of these respective runways. As such, please refrain from requesting for a change in landing runway (i.e. 02C or 20C)

5.3. Prior to reaching TOD, pilot shall make another call to request CDO execution:

"Request descent"

- Once cleared for descent:
- Start descent at the calculated FMC TOD based on the planned lateral and vertical path;
- Use lateral and vertical navigation functions of the FMC throughout CDO execution.

5.4. When transferred to another ATC sector / frequency, always inform the next sector that flight is on CDO upon initial contact:

"Singapore [ATC sector transferred to], [flight callsign], **on C-D-O** [read as See-Dee-Oh] to [last cleared altitude by ATC], Runway [runway-in-use]"

5.5. Once in contact with Singapore Arrival, ATC shall issue onward clearance to facilitate final phase of the CDO flight. Clearance would be in the following form:

"[flight callsign], **descend to [altitude], cleared ILS approach** Runway [runway-in-use]"

- With this clearance, pilot may proceed on remaining route of CDO flight procedure (see Attachments 1 and 2) to intercept on the appropriate ILS.

NOTE:

- During CDO, standard ATC procedures continue to apply. ATC may at times clear you to an intermediate level which would still facilitate a CDO profile. In doing so, ATC shall endeavour to issue further descent clearance prior to the CDO flight reaching 3000ft from last assigned altitude so as to prevent leveling off.
- If CDO flight has commenced and in the course of the CDO execution, Changi changes direction of its runway-in-use, i.e. R02 to R20 or vice versa, ATC shall advise if the CDO flight can resume and issue the necessary re-clearance. Pilot shall then re-plan arrival route to the revised landing runway and advice ATC if the flight would still be able to meet all the required speed/altitude restrictions.

5.6. Deviation from lateral or vertical path - At times, it may be necessary for ATC to take you off track temporarily or stop descent at an intermediate level due to a change in traffic situation. When instructed, pilot shall comply with ATC instructions until such a time when informed that the CDO flight can resume.

5.7. Termination of a CDO - In the event that traffic complexity reaches a stage where cancellation of the CDO flight becomes necessary, ATC shall issue a clearance to terminate the CDO flight. In doing so, ATC shall use the following phrase to terminate the CDO flight:

> "[callsign], [reason for CDO termination], **C-D-O** [read as See-Dee-Oh] **is now terminated**. [other ATC instructions that may follow]…"

5.8. Radio Communication Failure - In the event of a radio communication failure, CDO flight is to be terminated immediately and pilot is to apply the radio communication failure procedures stated in the Singapore AIP (ENR 1.6-3 to 1.6-4).

6. CDO Flight Procedures

6.1. The CDO flight shall track along the CDO RNAV STARs up to the intermediate segment and ILS procedure for the final and missed approaches for the respective runways. The CDO RNAV STARs have been designed as closed approaches into Changi, special provisions have been made herein to facilitate CDO flight joining the ILS Approach from the RNAV STAR. Please refer to **Attachments 1 and 2** for the charts and descriptions of the CDO RNAV STARs.

6.2. In the event that airborne RNAV equipment fails, pilot shall inform ATC as soon as practicable. ATC shall then terminate CDO operation and resume with radar vectors to aid pilot in landing into Changi.

6.3. For each set of RNAV STAR, information on distance to threshold has been added to aid pilot in CDO planning and execution and to reduce radio voice transmissions between pilot and ATC. Altitude restrictions depicted on the chart shall have the following meaning:

Indication on Chart	Meaning
FL140	At or above FL140
4000	At or above 4000 ft
8000 4000	A flight window, i.e. at or above 4000ft and at or below 8000ft