>> **PBN** PERFORMANCE-BASED NAVIGATION SOLUTIONS

>> **El Salvador RNP AR Design**

EL SALVADOR
DETAILED DESIGN
ALT CONSTRAINTS ENTRY POINTS

QUOVADIS
an AIRBUS subsidiary

AIRBUS
PRO SKY

Sep 06, 2013

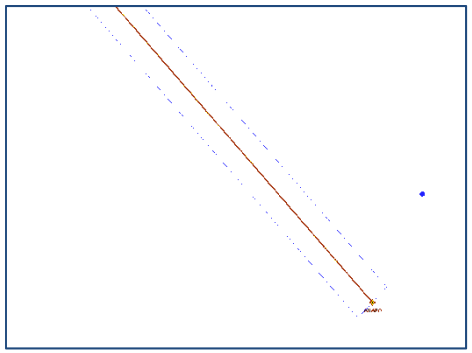
Document review

Version	Date	Author(s)	Review Descriptions
1.0	28 Apr 2013	Luca Zuccarini	Document first version with Track Miles Proposed Vs. Published.
2.0	06 Sep 2013	Luca Zuccarini	Document second version with waypoint coordinate changes and removed Track Miles Proposed Vs. Published.
3.0	19 Sep 2013	Luca Zuccarini	Document third version including simulator device tests with +FL200 at designed STAR entry waypoints for selected approaches.

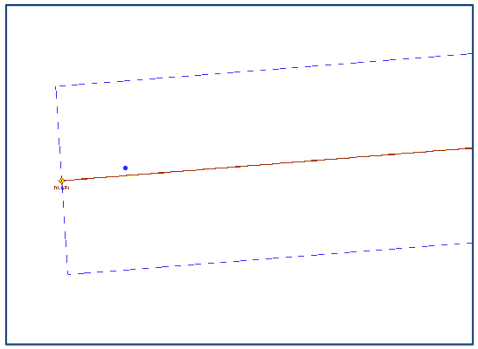
WAYPOINT COORDINATES MUST BE CONFIRMED AS THEY WILL HAVE AN EFFECT ON ALREADY DESIGNED PROCEDURES PER THE SIGNED SPEC

Waypoint Name	Spec. Coordinates	Updated Waypoint Name	New. Coordinates	Difference (m)	Difference (nm)	Spec. Altitude / Speed Constraint (**)	New Altitude / Speed Constraint	Waypoint Function
DUNEL (W)	134356.34N 0900632.55W		134401.54N 0900605.04W	841.81	0.45		At or above 20000 ft?	Entry / Exit
OTAMI (WNW)	140302.72N 0895214.67W	KAPAN (WNW)	140330.44N 0895118.99W	1875.22	1.01	At or above 10000ft	At or above 20000 ft?	Entry / Exit
OBRAS (WNW)	135748.00N 0895838.00W		No change		0.00	At or above 10000ft	Waypoint assigned to Guatemala. At or above 20000 ft?	Entry / Exit
NOVOG (N)	142142.00N 0891018.00W		142110.11N 0890950.51W	1280.25	0.69		At or above 20000 ft?	Entry / Exit
URNOS (N)	141930.00N 0885718.00W		141907.20N 0885719.33W	701.87	0.38		At or above 20000 ft?	Entry / Exit
NAGEL (NNE)	141548.00N 0883524.00W		141531.08N 0883530.70W	557.45	0.30		It is in Honduras. Is there an altitude constraint required for exit and entry?	Entry / Exit
VITAN (ENE)	135142.00N 0874500.00W		135143.97N 0874501.13W	69.4	0.04		At or above 20000 ft?	Entry / Exit
TUKOR (ESE)	125312.00N 0874900.00W		125319.36N 0874855.86W	258.33	0.14		It is in the sea. Is there an altitude constraint required for exit and entry?	Entry / Exit
ANAPO (SE)	123148.00N 0875956.00W	To be confirmed	123444.89N 0875825.05W	6089.8	3.29		It is in the sea. Is there an altitude constraint required for exit and entry?	Entry / Exit

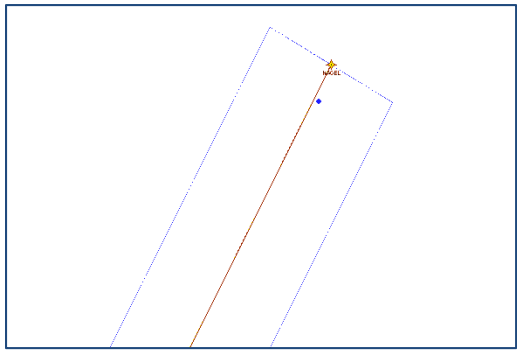
ANAPO



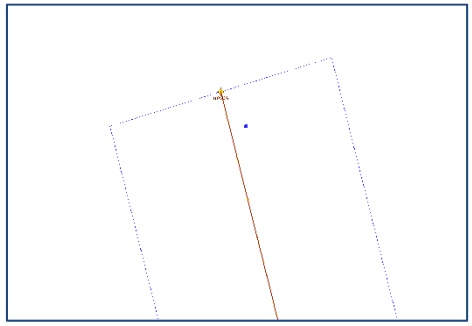
DUNEL



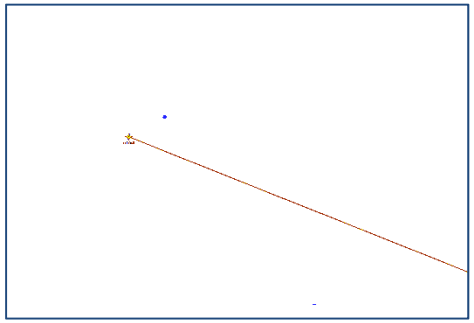
NAGEL



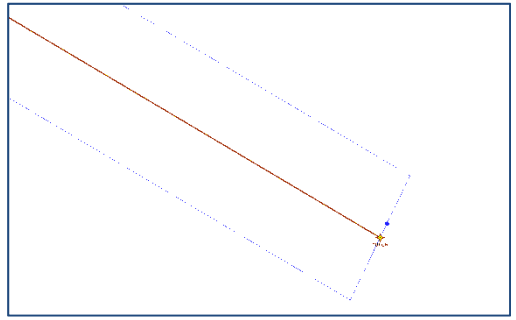
NOVOG



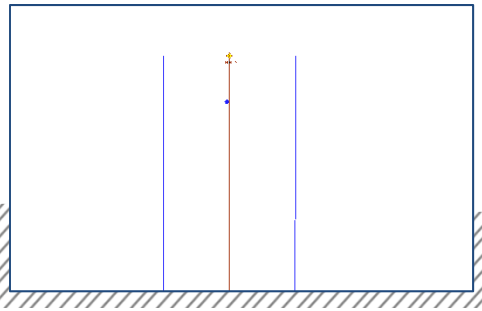
KAPAN



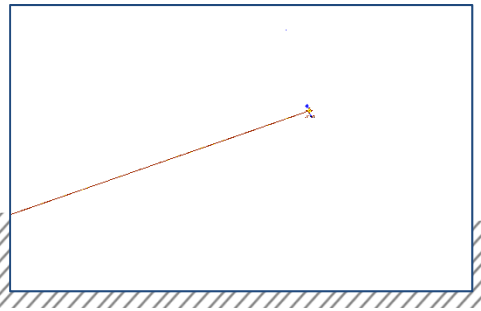
TUKOR



URNOS



VITAN

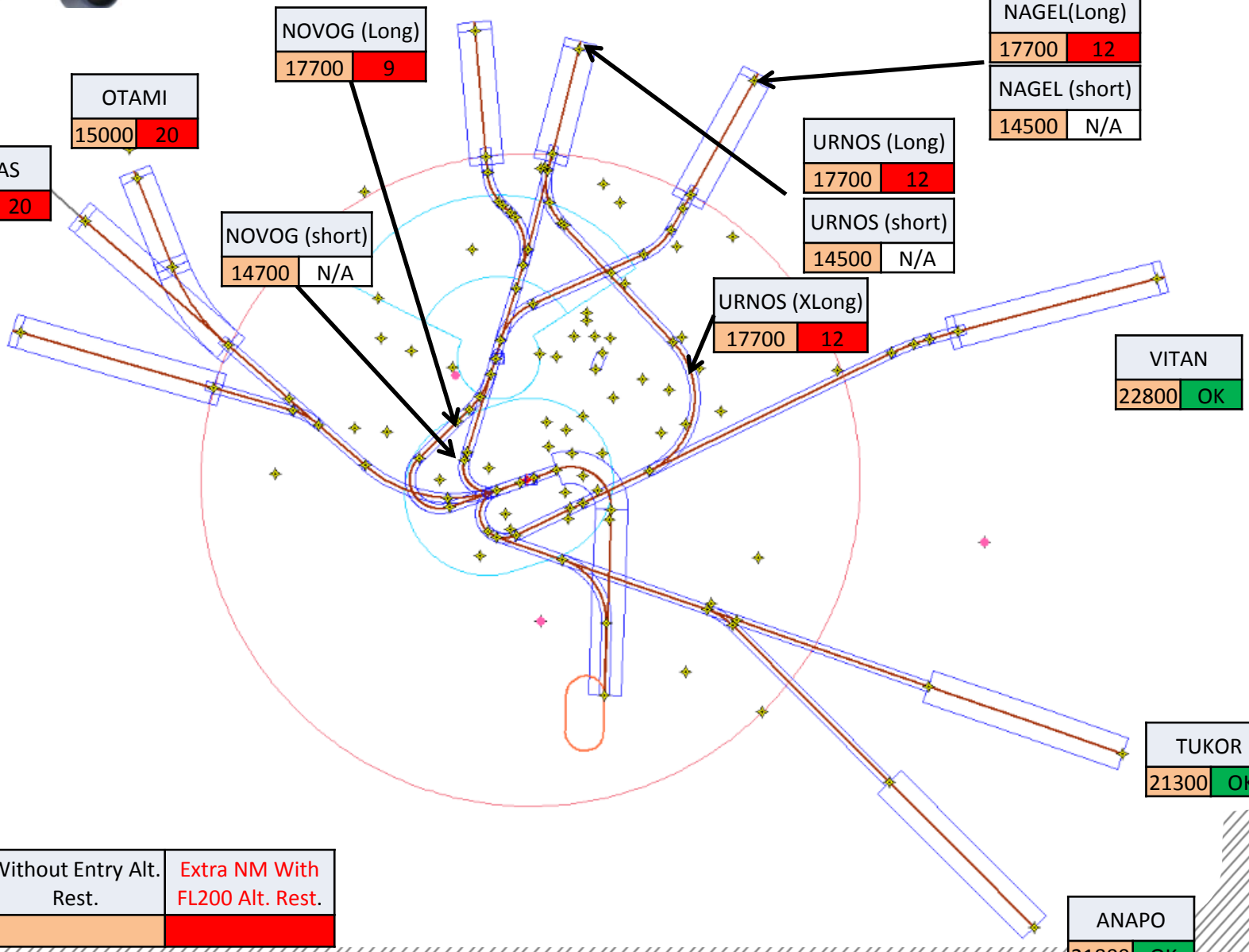


Min-Max Altitude Constraints at Entry Points

RWY 07

APPROACHES	MIN ALT			MIN/MAX ALTITUDES @ ENTRY POINTS					
				MAX ALT					
				MAX ALT Cat C		MAX ALT Cat C		MAX ALT Cat D	
	MOCA* (FT)	ATC RESTRIC	Entry Alt Rest.	Without Entry Alt. Rest.	Extra NM With Alt. Rest.	Without Entry Alt. Rest.	Extra NM With Alt. Rest.	Without Entry Alt. Rest.	Extra NM With Alt. Rest.
DUNEL	2700	3000	20000	13000	33	14900	20	15500	18
OBRAS	8200	8200	20000	13000	33	14900	20	15500	18
OTAMI	8200	8200	20000	13100	33	15000	20	15600	18
NOVOG LONG	8700	8700	20000	15300	22	17700	9	18300	7
NOVOG SHORT	8700	8700	N/A	12900	N/A	14700	N/A	15400	N/A
URNOS LONG	7600	*8000 Ft*	20000	14700	25	17000	12	17600	10
URNOS SHORT	7600	*8000 Ft*	N/A	12700	N/A	14500	N/A	15100	N/A
URNOS X-LONG	7600	*8000 Ft*	20000	18500	7	21400	-6	22000	-8
NAGEL LONG	7900	*8000 Ft*	20000	16700	16	19300	3	19900	0
NAGEL SHORT	7900	*8000 Ft*	N/A	14700	N/A	16800	N/A	17500	N/A
VITAN	7500	7500	20000	19600	2	22800	-11	23400	-14
TUKOR	1200	3000	20000	18300	8	21300	-5	21900	-8
ANAPO	1200	3000	20000	18800	6	21800	-7	22400	-10
	*Expected MOCAs			A330		A320		A321	

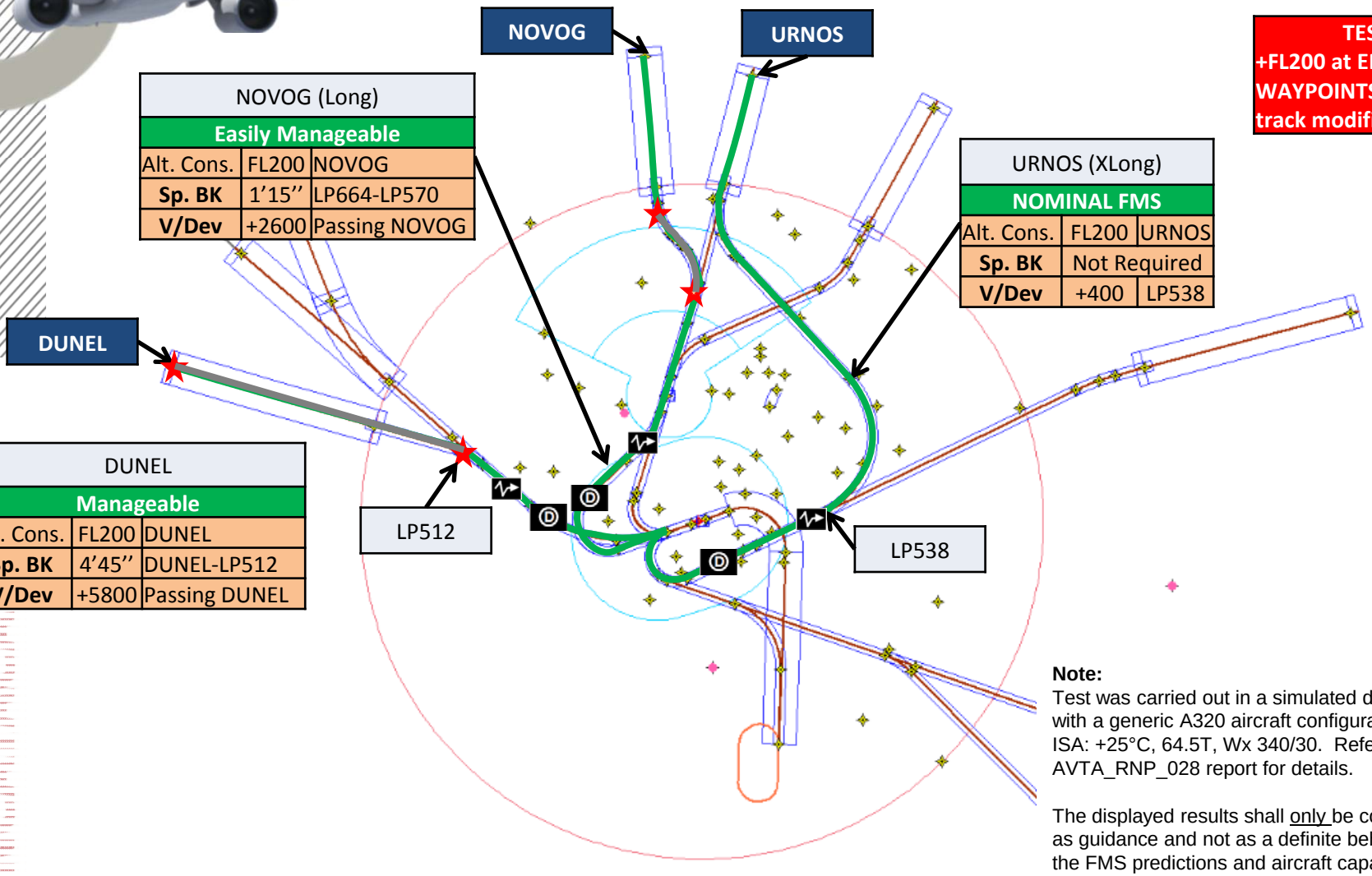
RNP Approaches RWY 07 – CAT C (A320)



Without Entry Alt. Rest.	Extra NM With FL200 Alt. Rest.

RNP Approaches RWY 07 – SIM#2 Results

TEST:
+FL200 at ENTRY WAYPOINTS with no track modifications



NOVOG (Long)		
Easily Manageable		
Alt. Cons.	FL200	NOVOG
Sp. BK	1’15’’	LP664-LP570
V/Dev	+2600	Passing NOVOG

URNOS (XLong)		
NOMINAL FMS		
Alt. Cons.	FL200	URNOS
Sp. BK	Not Required	
V/Dev	+400	LP538

DUNEL		
Manageable		
Alt. Cons.	FL200	DUNEL
Sp. BK	4’45’’	DUNEL-LP512
V/Dev	+5800	Passing DUNEL

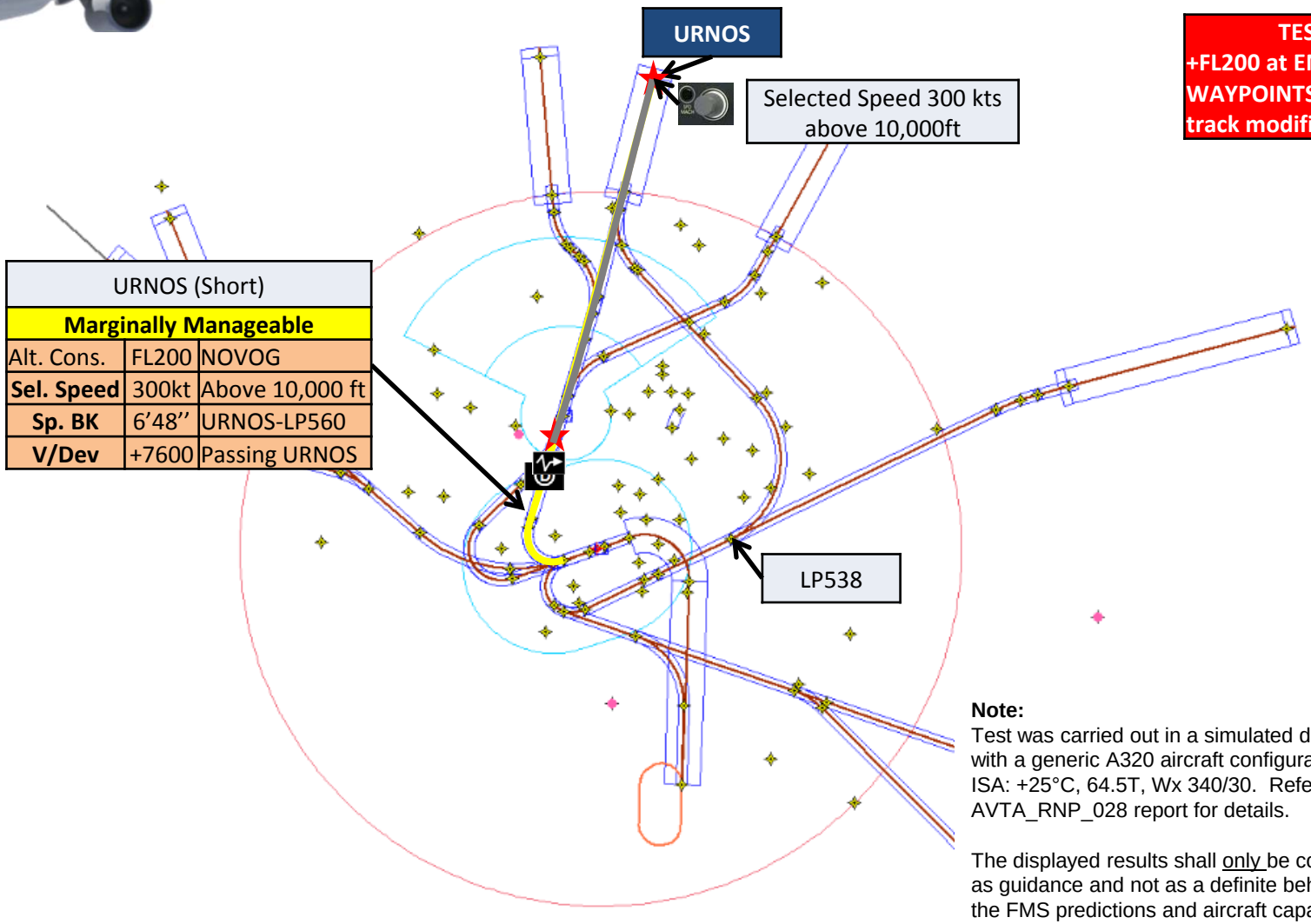
Speed Break use	Decel. point	Vertical Profile Intercept
	Ⓓ	

Note:
Test was carried out in a simulated device, with a generic A320 aircraft configuration, D-ISA: +25°C, 64.5T, Wx 340/30. Refer to the AVTA_RNP_028 report for details.

The displayed results shall only be considered as guidance and not as a definite behaviour of the FMS predictions and aircraft capabilities. Depending, among other things, on weather conditions, aircraft descent points, a/c weights, pilot intervention; the predictions might be different to what illustrated.

RNP Approaches RWY 07 – SIM#2 Results

TEST:
+FL200 at ENTRY WAYPOINTS with no track modifications



URNOS (Short)		
Marginally Manageable		
Alt. Cons.	FL200	NOVOG
Sel. Speed	300kt	Above 10,000 ft
Sp. BK	6'48''	URNOS-LP560
V/Dev	+7600	Passing URNOS

Speed Break use	Decel. point	Vertical Profile Intercept	Speed – Crew Inervention

Note:
Test was carried out in a simulated device, with a generic A320 aircraft configuration, D-ISA: +25°C, 64.5T, Wx 340/30. Refer to the AVTA_RNP_028 report for details.

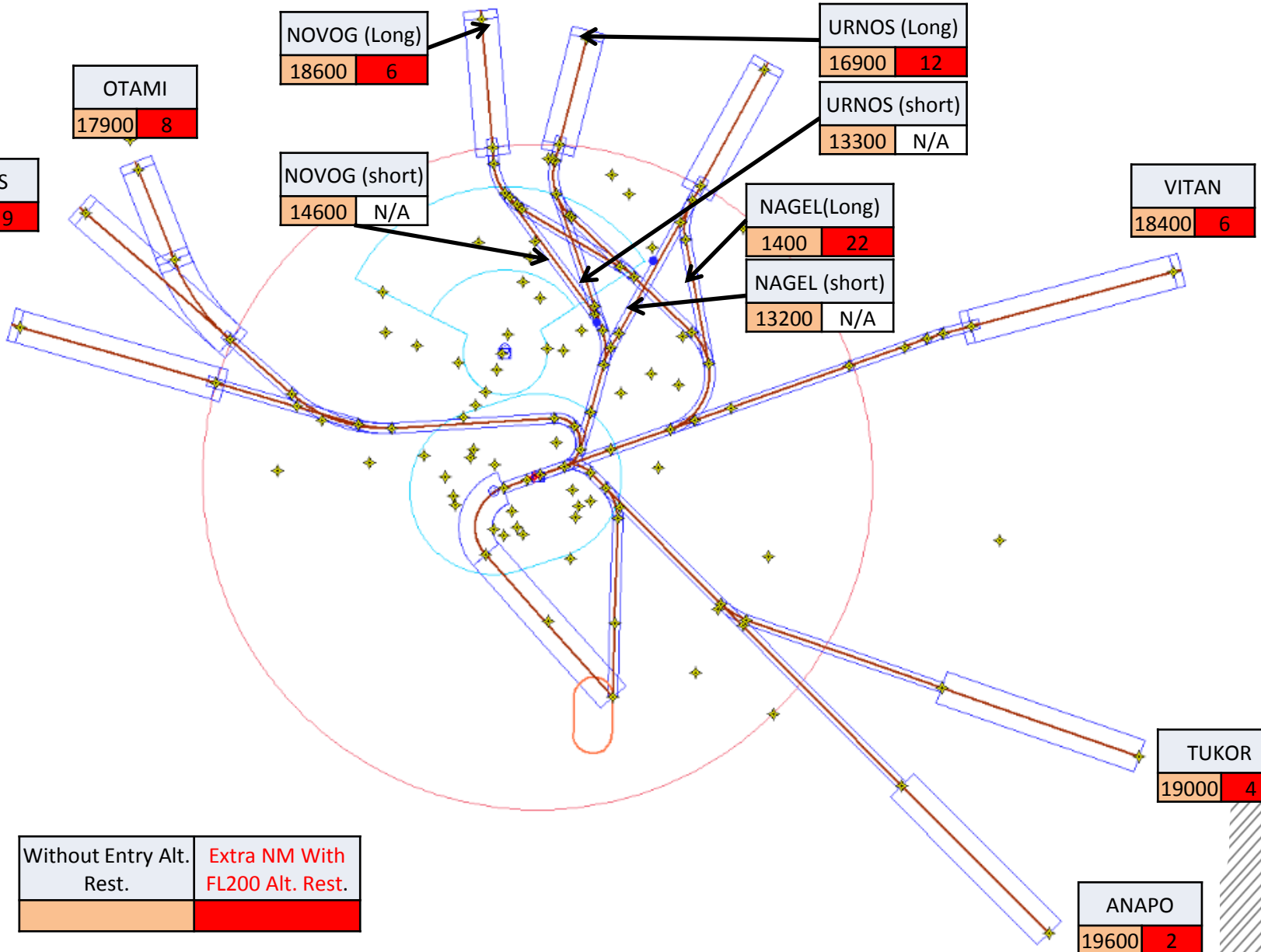
The displayed results shall only be considered as guidance and not as a definite behaviour of the FMS predictions and aircraft capabilities. Depending, among other things, on weather conditions, aircraft descent points, a/c weights, pilot intervention; the predictions might be different to what illustrated.

Min-Max Altitude Constraints at Entry Points

RWY 25

APPROACHES	MIN ALT			MIN/MAX ALTITUDES @ ENTRY POINTS					
				MAX ALT					
	MOCA* (FT)	ATC RESTRIC	Entry Alt Rest.	MAX ALT Cat C		MAX ALT Cat C		MAX ALT Cat D	
				Without Entry Alt. Rest.	Extra NM With Alt. Rest.	Without Entry Alt. Rest.	Extra NM With Alt. Rest.	Without Entry Alt. Rest.	Extra NM With Alt. Rest.
DUNEL	3500	3500	20000	15500	21	17900	8	18500	6
OBRAS	8200	8200	20000	15400	22	17800	9	18400	6
OTAMI	8200	8200	20000	15500	21	17900	8	18500	6
NOVOG LONG	8700	8700	20000	16100	19	18600	6	19200	3
NOVOG SHORT	8700	8700	N/A	12800	N/A	14600	N/A	15200	N/A
URNOS LONG	7600	*8000 Ft*	20000	14600	26	16900	12	17500	10
URNOS SHORT	7600	*8000 Ft*	N/A	11800	N/A	13300	N/A	14000	N/A
NAGEL LONG	7900	*8000 Ft*	20000	12800	34	14600	22	15200	19
NAGEL SHORT	7900	*8000 Ft*	N/A	11700	N/A	13200	N/A	13900	N/A
VITAN	7500	7500	20000	16000	19	18400	6	19000	4
TUKOR	1200	3000	20000	16500	17	19000	4	19600	2
ANAPO	1300	3000	20000	17000	14	19600	2	20200	-1
	*Expected MOCAs			A330		A320		A321	

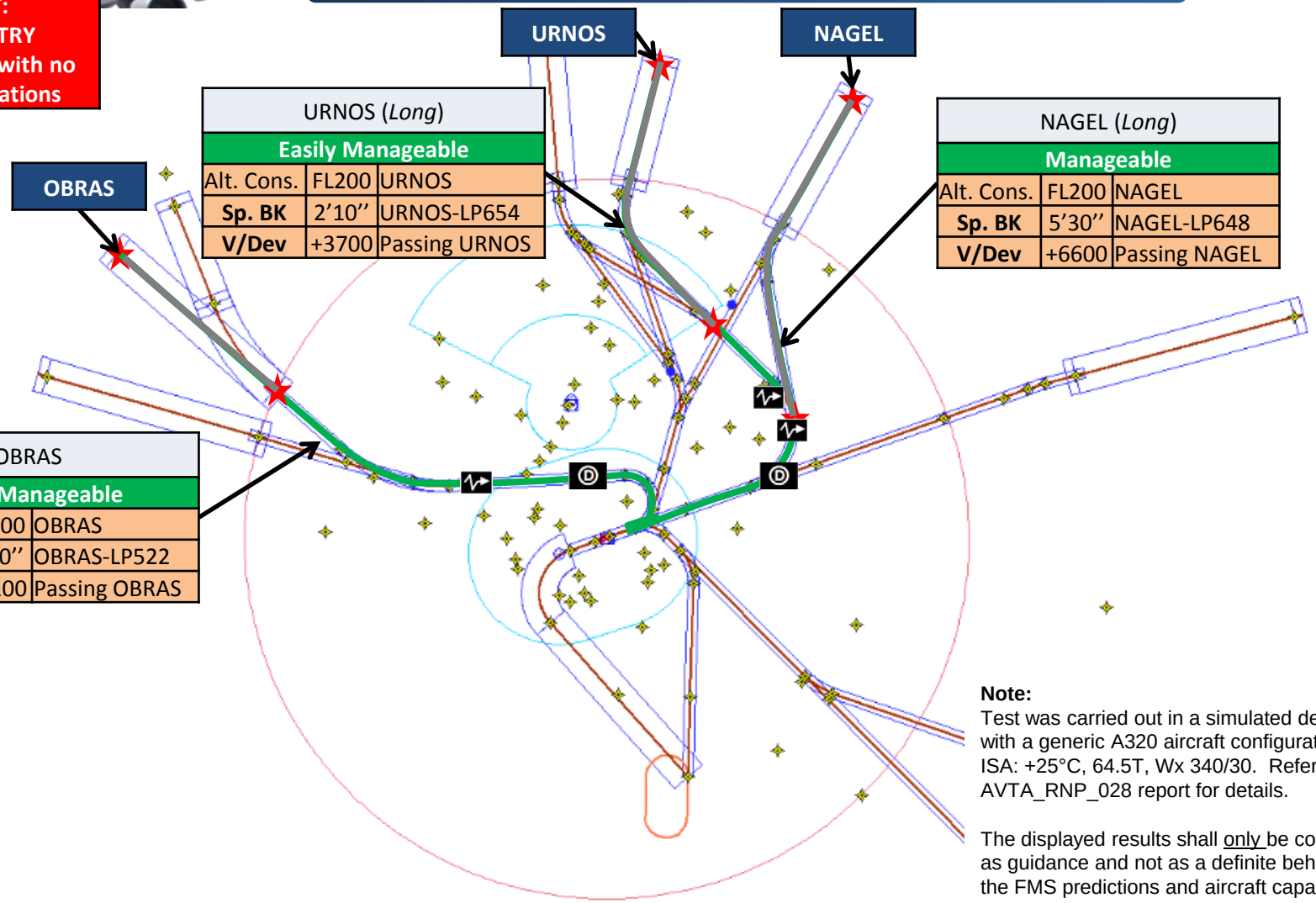
RNP Approaches RWY 25 – CAT C (A320)



Without Entry Alt. Rest.	Extra NM With FL200 Alt. Rest.

RNP Approaches RWY 25 – SIM#2 Results

TEST:
+FL200 at ENTRY WAYPOINTS with no track modifications



URNOS (*Long*)		
Easily Manageable		
Alt. Cons.	FL200	URNOS
Sp. BK	2’10’’	URNOS-LP654
V/Dev	+3700	Passing URNOS

NAGEL (*Long*)		
Manageable		
Alt. Cons.	FL200	NAGEL
Sp. BK	5’30’’	NAGEL-LP648
V/Dev	+6600	Passing NAGEL

OBRAS		
Easily Manageable		
Alt. Cons.	FL200	OBRAS
Sp. BK	2’10’’	OBRAS-LP522
V/Dev	+3100	Passing OBRAS

Speed Break use	Decel. point	Vertical Profile Intercept	Speed – Crew Inervention

Note:
Test was carried out in a simulated device, with a generic A320 aircraft configuration, D-ISA: +25°C, 64.5T, Wx 340/30. Refer to the AVTA_RNP_028 report for details.

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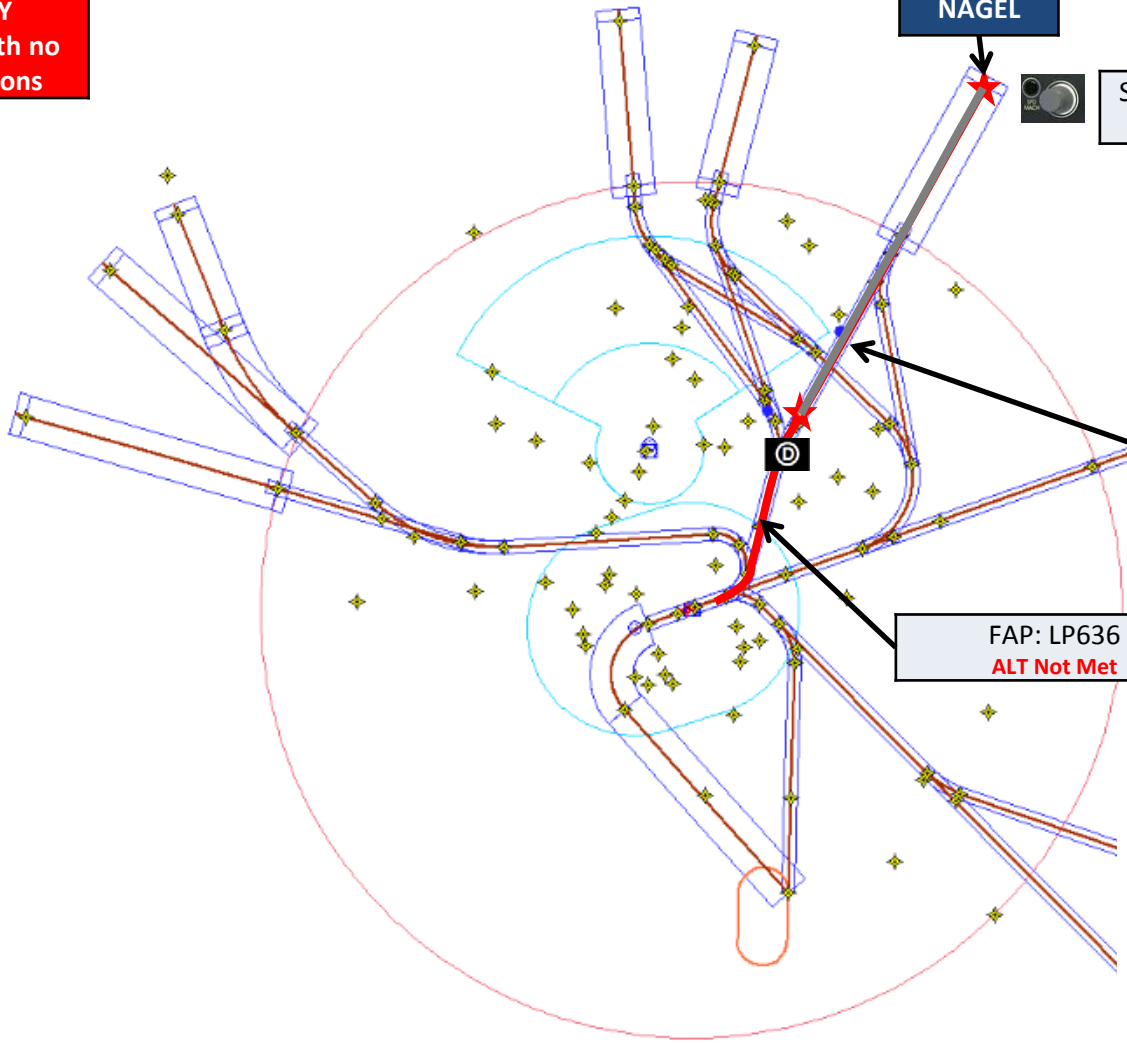
RNP Approaches RWY 25 – SIM#2 Results

TEST:
+FL200 at ENTRY WAYPOINTS with no track modifications



NAGEL (*Short*)		
Non Manageable		
Alt. Cons.	FL200	NAGEL
Sp. BK	5'20''	NAGEL-LP686
V/Dev	+8900	Passing NAGEL
LG	Down	AT 10,000ft
Wind	340/30	

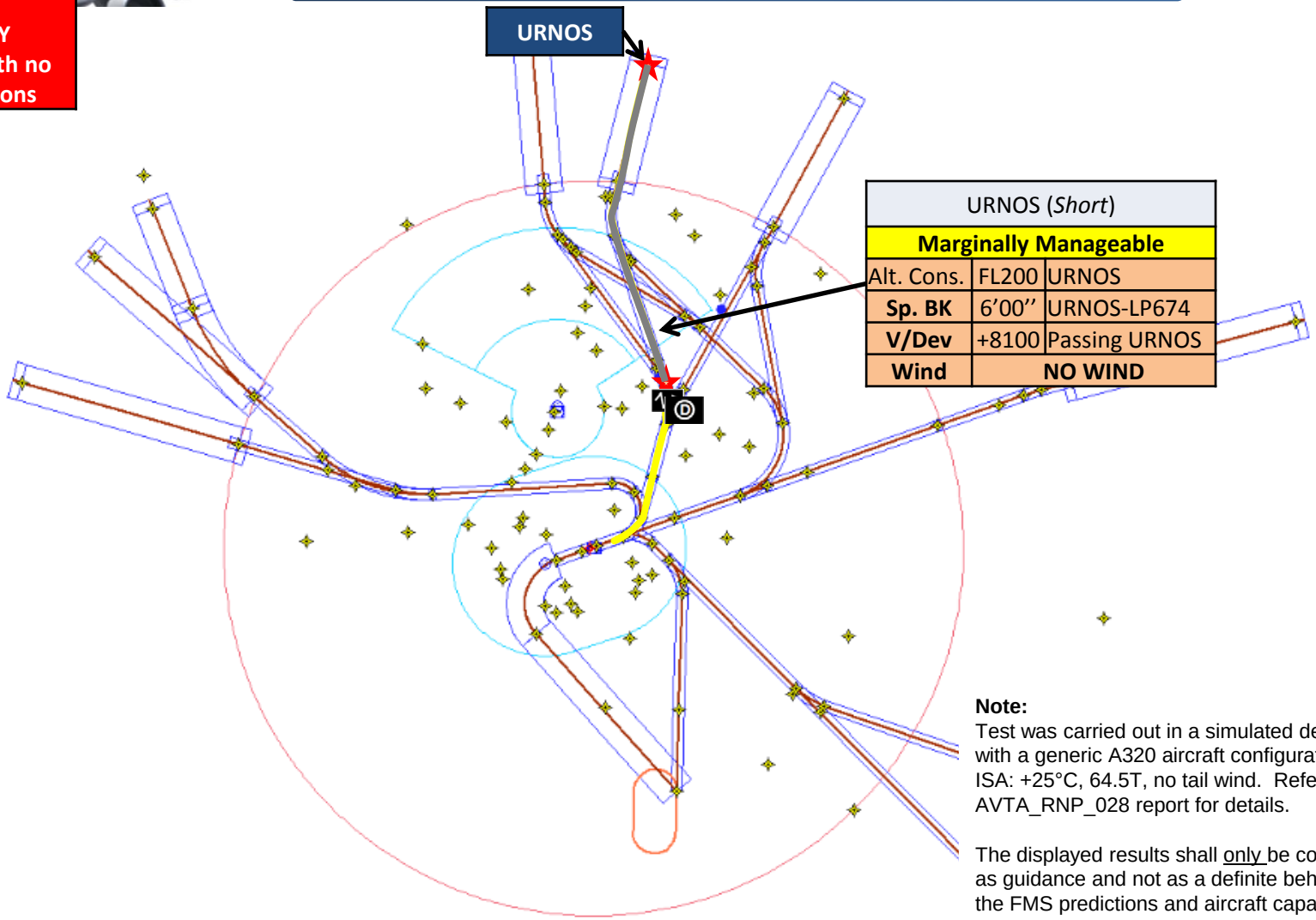
Speed Break use	Decel. point	Vertical Profile Intercept	Speed – Crew Inervention

Note:
Test was carried out in a simulated device, with a generic A320 aircraft configuration, D-ISA: +25°C, 64.5T, Wx 340/30. Refer to the AVTA_RNP_028 report for details.

The displayed results shall only be considered as guidance and not as a definite behaviour of the FMS predictions and aircraft capabilities. Depending, among other things, on weather conditions, aircraft descent points, a/c weights, pilot intervention; the predictions might be different to what illustrated.

RNP Approaches RWY 25 – SIM#2 Results

TEST:
+FL200 at ENTRY WAYPOINTS with no track modifications



URNOS (*Short*)		
Marginally Manageable		
Alt. Cons.	FL200	URNOS
Sp. BK	6’00’’	URNOS-LP674
V/Dev	+8100	Passing URNOS
Wind	**NO WIND**	

Speed Break use	Decel. point	Vertical Profile Intercept	Speed – Crew Inervention

Note:
Test was carried out in a simulated device, with a generic A320 aircraft configuration, D-ISA: +25°C, 64.5T, no tail wind. Refer to the AVTA_RNP_028 report for details.

The displayed results shall only be considered as guidance and not as a definite behaviour of the FMS predictions and aircraft capabilities. Depending, among other things, on weather conditions, aircraft descent points, a/c weights, pilot intervention; the predictions might be different to what illustrated.


Think the solution,
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ANY QUESTIONS ?