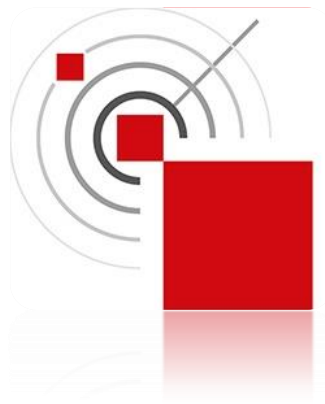


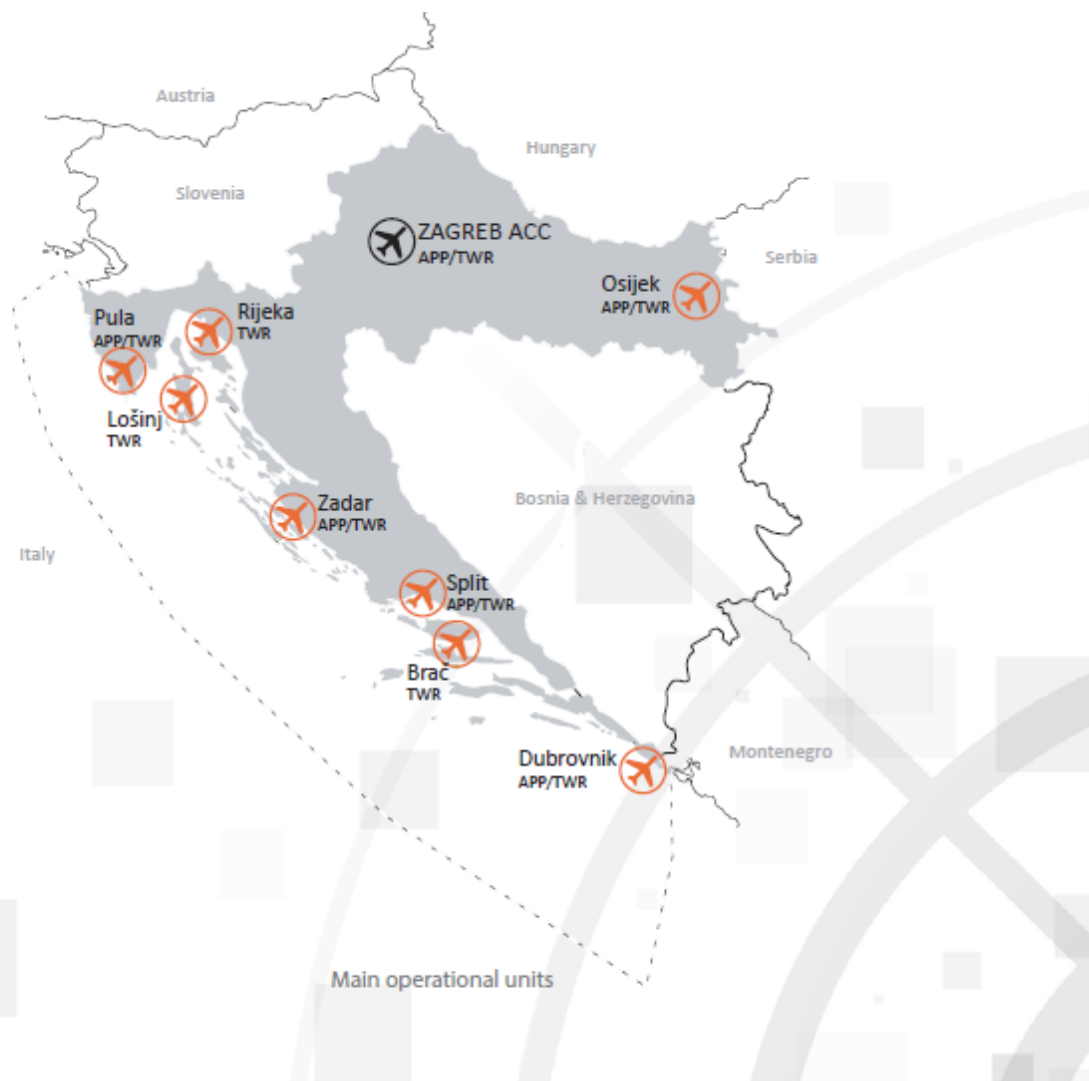


The Croatian case: LPV implementation benefits Croatia Control

Josip Josipović

*Executive Director, Regional ATC Centres
Croatia Control Ltd.*

CROATIAN INTERNATIONAL AERODROMES



RNP APPROACH IMPLEMENTATION PLAN

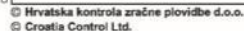
AD	RWY	LPV	IMPLEMENT
LDDU	11	LNAV,LNAV/VNAV,LPV	2015-2019
	29	RNP AR	
LDLO	2	NO	WAITING RWY RECONSTRUCTION
	22		
LDOS	11	LNAV,LNAV/VNAV,LPV	2017-2018
	29	NO	
LDPL	9	LNAV,LNAV/VNAV,LPV	2018
	27	LNAV,LNAV/VNAV,LPV	2018
LDRI	14	LNAV,LNAV/VNAV,LPV	05DEC2019
	32	LNAV,LNAV/VNAV,LPV	05DEC2019
LDSB	4	LNAV,LNAV/VNAV,LPV	05DEC2019
	22	LNAV,LNAV/VNAV,LPV	05DEC2019
LDSP	5	LNAV,LNAV/VNAV,LPV	2018
	23	RNAV VISUAL	2018
LDZA	5	LNAV,LNAV/VNAV,LPV	2018
	23	LNAV,LNAV/VNAV,LPV	2018
LDZD	4	LNAV,LNAV/VNAV,LPV	2018
	13	LNAV,LNAV/VNAV,LPV	2018
	22	NO	
	31	LNAV,LNAV/VNAV,LPV	2018

The benefits of LPV implementation

- ❖ LPV approaches eliminate the need for critical area limitations associated with an ILS
- ❖ LPV procedures have no requirements for ground-based transmitters at the airport
- ❖ From pilot's viewpoint, an LPV approach looks and flies like an ILS but LPV is more stable due to guidance not being provided via RF technology
- ❖ The LPV approach glide slope is based on the SBAS-based altitude versus the barometric altimeter which is subject variations due to extreme temperatures or pilot error in the setting of the local altimeter setting
- ❖ LPV enables a continuous descent final approach guidance to the crew as opposed to the „dive and drive“ technique associated with Non-Precision approaches which are cause of many CFIT accidents
- ❖ LPV Approaches are added to runways that have not been suitable for IFR operations

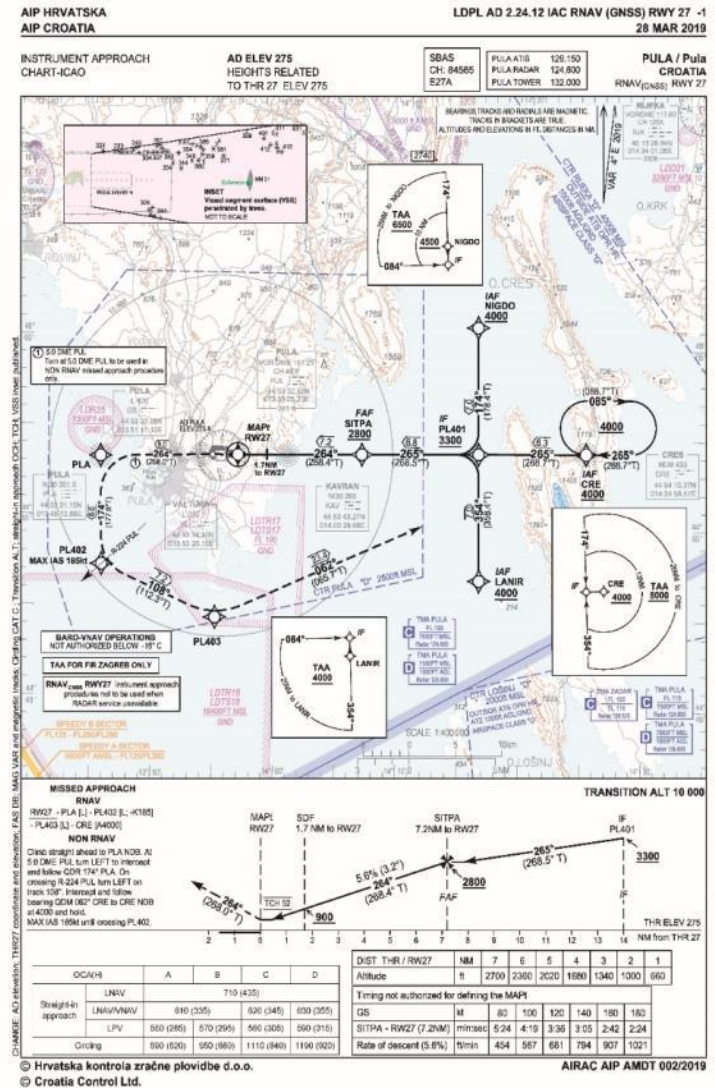
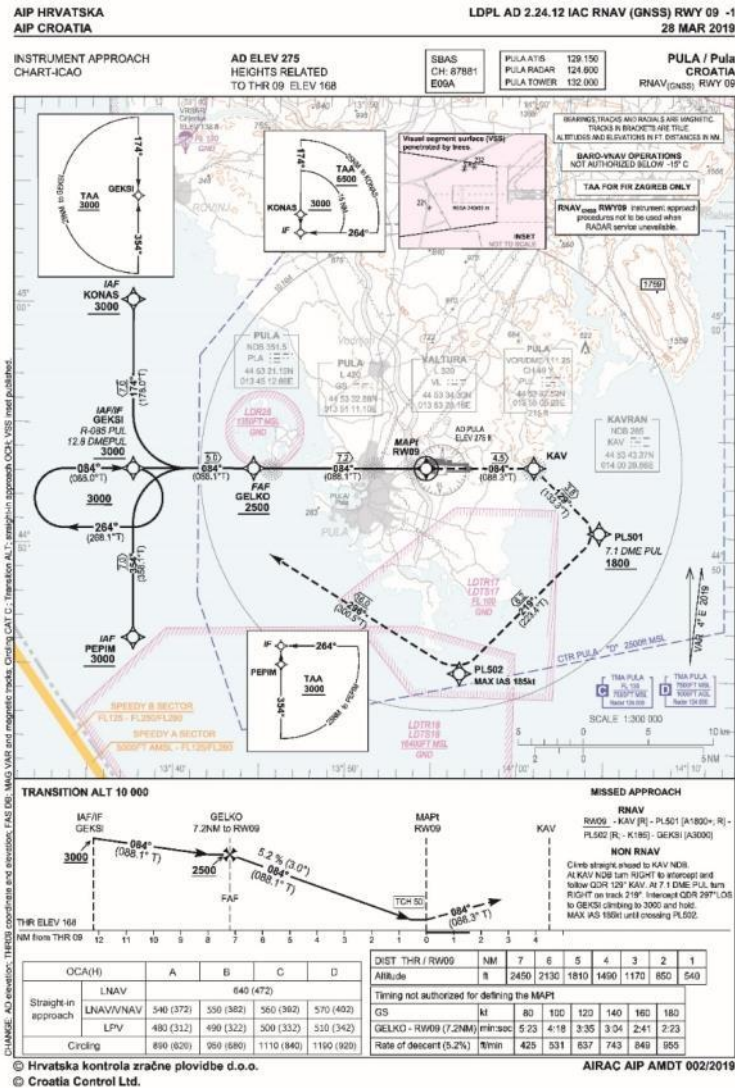
Other operational benefits:

- ❖ Reduces trajectory dispersion(predictability and noise footprint reduction)
- ❖ More flexible use of airspace
- ❖ Enabling CDA/CDFA techniques (fuel consumption and noise footprint reduction)
- ❖ LPV offer potential to remove circling approaches
- ❖ Potentially enabling VOR, NDB, ILS removal, reducing the associated installation/maintenance costs
- ❖ Limited impact on the FMS
- ❖ Low training requirements for flight crews



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Aerodrome Pula RWY 09 has only VOR&NDB Non-Precision approach



Aerodrome Zadar (only RWY 14 ILS Precision approach)

AIP HRVATSKA
AIP CROATIA

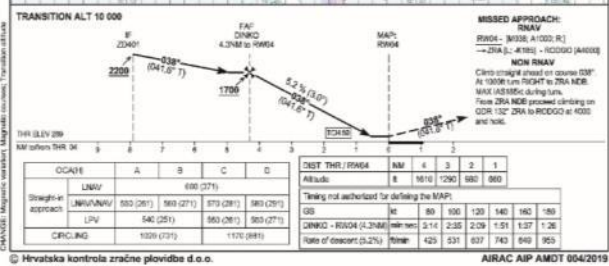
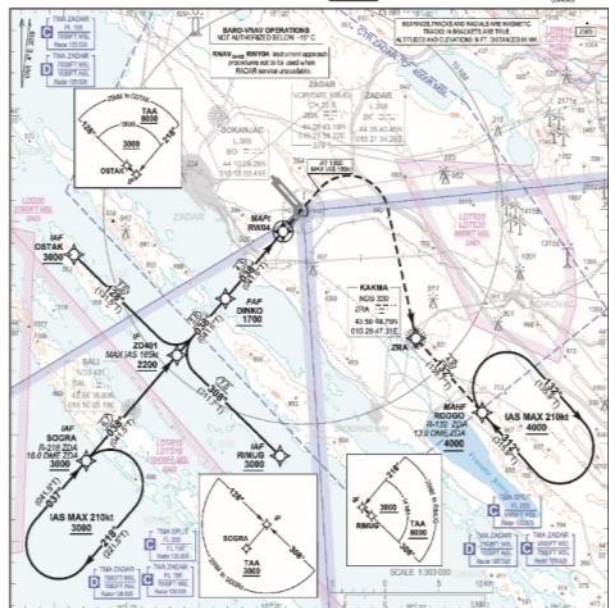
LDZD AD 2.24.12 IAC RNAV (GNSS) RWY 04 -1
23 MAY 2019

INSTRUMENT APPROACH
CHART-ICAO

AD ELEV 289
HEIGHTS RELATED
TO THR 04 ELEV 289

SBAS
Ch: 52308
E13A

ZADAR / Zemunik
CROATIA
RNAV(GNSS) RWY 04



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AIP HRVATSKA
AIP CROATIA

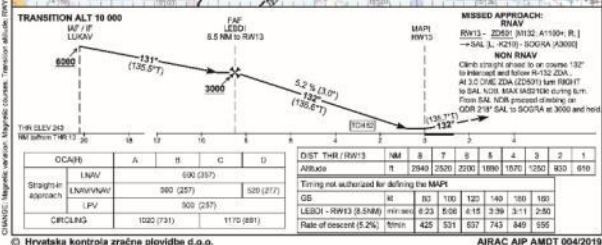
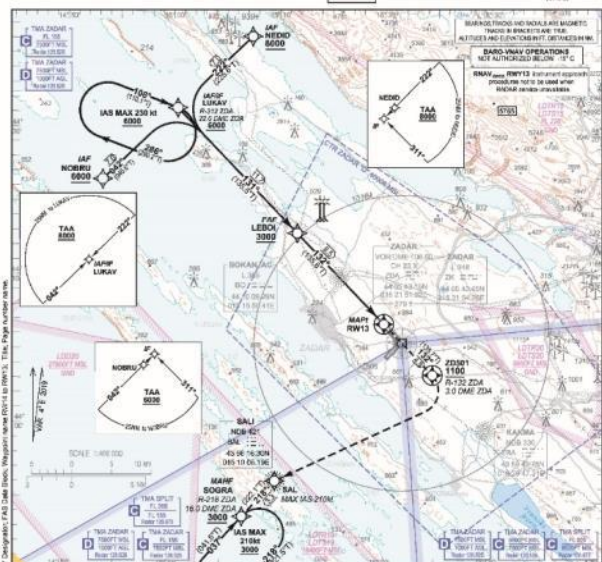
LDZD AD 2.24.12 IAC RNAV (GNSS) RWY 13 -1
23 MAY 2019

INSTRUMENT APPROACH
CHART-ICAO

AD ELEV 289
HEIGHTS RELATED
TO THR 13 ELEV 243

SBAS
Ch: 52308
E13A

ZADAR / Zemunik
CROATIA
RNAV(GNSS) RWY 13



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AIP HRVATSKA
AIP CROATIA

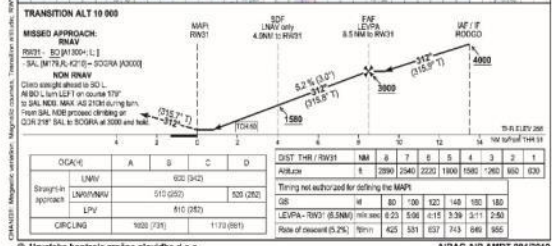
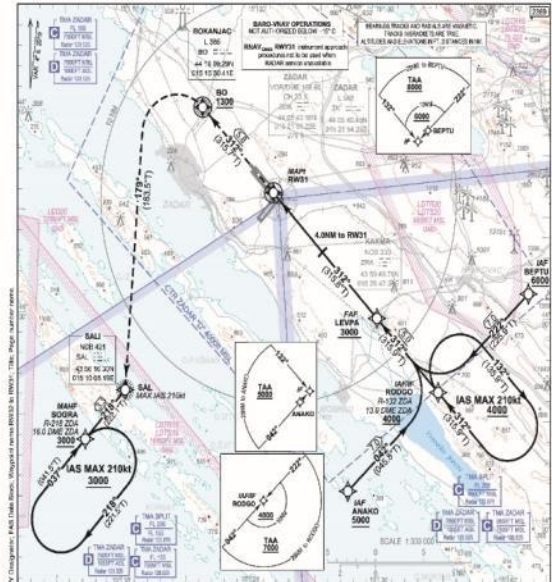
LDZD AD 2.24.12 IAC RNAV (GNSS) RWY 31 -1
23 MAY 2019

INSTRUMENT APPROACH
CHART-ICAO

AD ELEV 289
HEIGHTS RELATED
TO THR 31 ELEV 208

SBAS
Ch: 52308
E13A

ZADAR / Zemunik
CROATIA
RNAV(GNSS) RWY 31



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Aerodrome Brač I.(only NDB Non-Precision Approach)

AIP HRVATSKA
AIP CROATIA

This IF procedure shall be used for flight validation purposes only.

LDSB AD 2.24.12 IAC RNAV (GNSS) RWY 04 -1
Validity: 15 AUG 2019 - UFN

INSTRUMENT APPROACH
CHART-ICAO

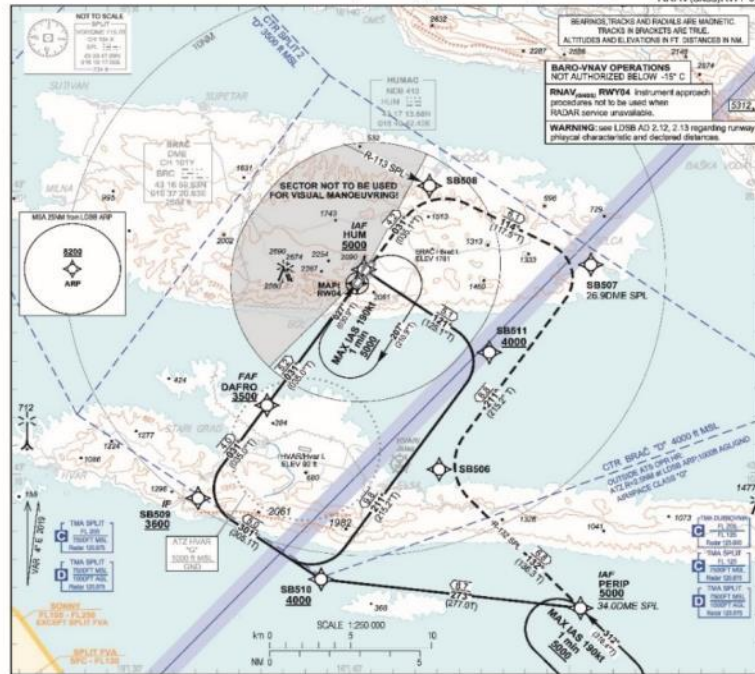
AD ELEV 1781
HEIGHTS RELATED
TO THR 04 ELEV 1779

SBAS
CH:60004
E04A

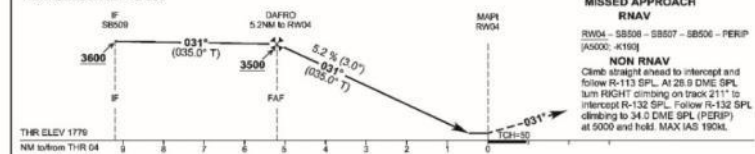
SPLIT RADAR
120.875

BRAC TOWER
118.025

BRAČ/Brač I.
CROATIA
AV (GNSS) RWY 04



TRANSITION ALT 10 000



OCA(H)		A	B	C
Straight-in approach	UNAV	2410 (630)		
	UNAV/VNAV	2300 (521)	2310 (531)	2310 (531)
	LPV	2290 (511)	2300 (521)	2310 (531)
Circling		2430 (650)		2520 (740)

DIST THRU/RW04	NM	5	4	3	2	1
Altitude	ft	3420	3100	2780	2470	2150

TIMING NOT AUTHORIZED FOR DEFINING THE MAP:

GS	ft	70	100	120	140	160
DA/FRO/RW04 (5.2NM)	min sec	4:27	3:07	2:36	2:14	1:57

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AIP SUP 008/2019

AIP HRVATSKA
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LDSB AD 2.24.12 IAC RNAV (GNSS) RWY 22 -1
Validity: 15 AUG 2019 - UFN

INSTRUMENT APPROACH
CHART-ICAO

AD ELEV 1781
HEIGHTS RELATED
TO THR 22 ELEV 1701

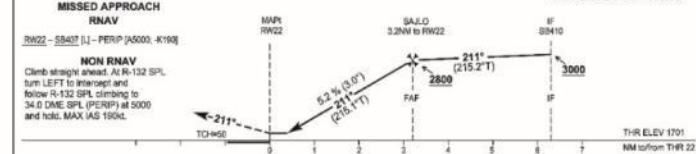
SPLIT RADAR
120.875

BRAC TOWER
11B.C25

BRAC/Brač I.
CROATIA
AV (GRSS) RWY 22



12345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989910010110210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913001



OCAB		A	B	C
Straight-in approach	LNW	2410 (710)		
	LNW/VNW	2290 (580)	2300 (590)	2310 (600)
	LPV	2290 (580)	2300 (590)	2310 (600)

TIMING NOT AUTHORIZED FOR DEFINING THE MAPI						
GS	ht	70	100	120	140	160
BAJLO – RW22 (3.2MM)	min : sec	2:45	1:56	1:36	1:22	1:12
Rate of descent (5.2%)	R/min	372	531	637	743	849

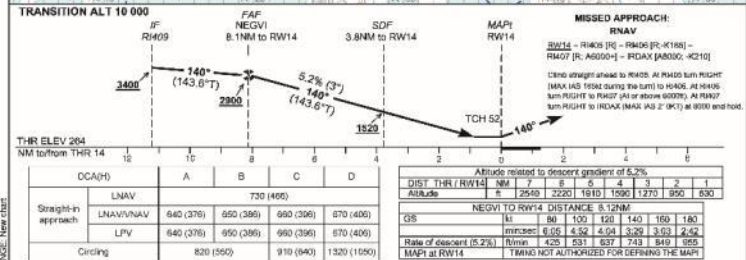
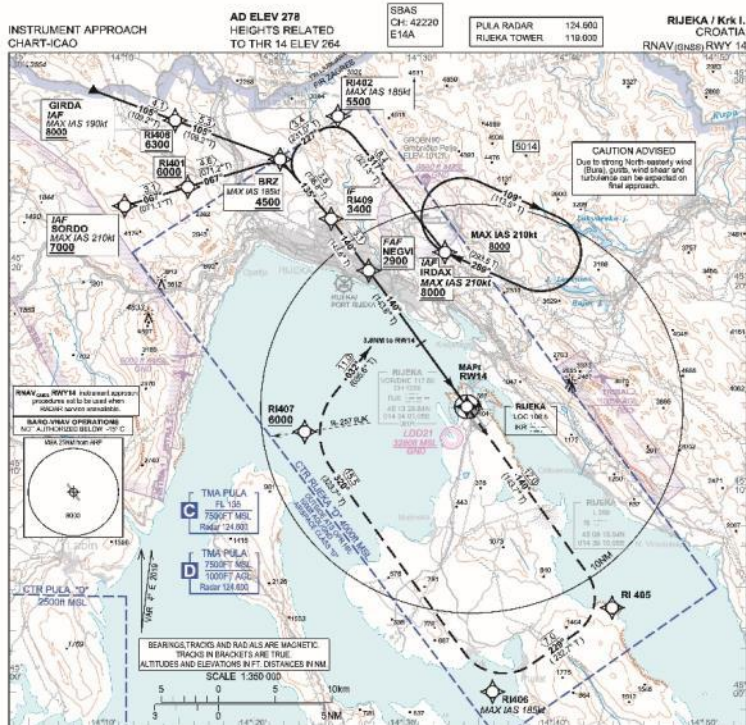
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⊕ Croatia Control Ltd.

AIP SUP 008/2019

Aerodrome Rijeka Krk I.(RWY 32 only VOR&NDB Non-Precision Approach)

AIP HRVATSKA This IF procedure shall be used
AIP CROATIA for flight validation purposes only

LDRI AD 2.24.12 IAC RNAV (GNSS) RWY 14 - 1
Validity: 12 SEP 2019 - UEN



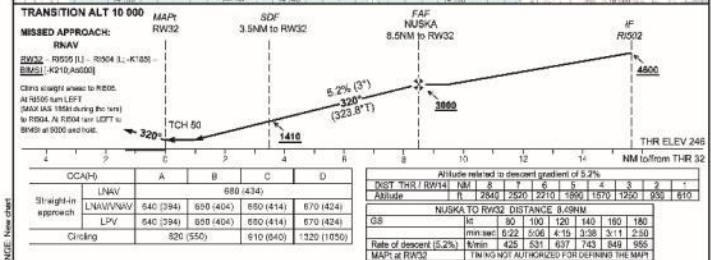
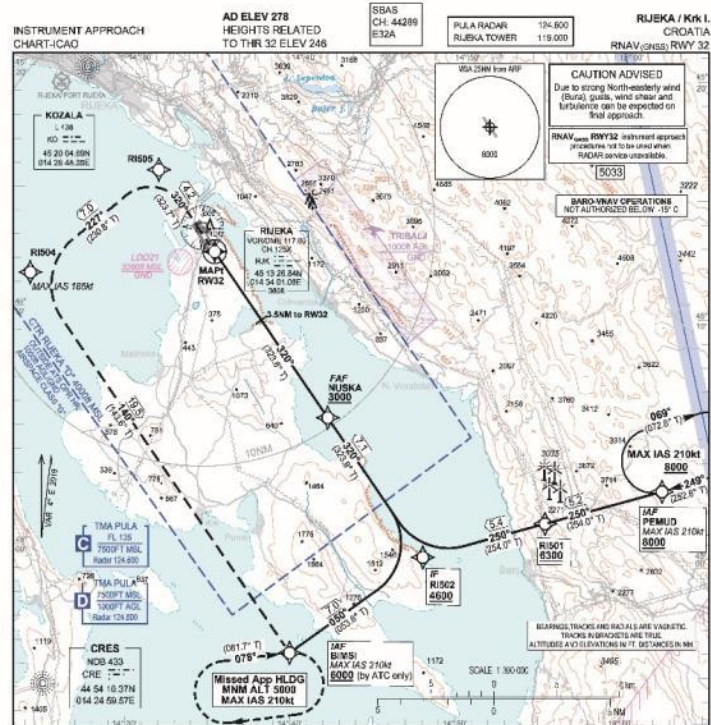
NOTE: Circling for ACFT CAT B, C and D NE of aerodrome NA

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AIP HRVATSKA This IF procedure shall be used
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LDR1 AD 2.24.12 IAC RNAV (GNSS) RWY 32 -1
Validity: 12 SEP 2019 - UEN



NOTE: Circling for ACFT CAT B, C and D NE of aerodrome NA

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FAS database coding list

LDRI AD 2.24.12 IAC RNAV (GNSS) RWY 14 -2
Validity: 12 SEP 2019 - UFN

This IF procedure shall be used
for flight validation purposes only.

AIP HRVATSKA
AIP CROATIA

RUEKA / Krk I.
CROATIA
RNAV (GNSS) RWY 14

Input data

Operation Type	0
SBAS Provider	1 (EGNOS)
Airport Identifier	LDRI
Runway	14
Runway Letter	0 (None)
Approach Performance Designator	0
Route Indicator	
Reference Path Data Selector	0
Reference Path Identifier	E14A
LTP/FTP Latitude	451332.3610N
LTP/FTP Longitude	0143341.1580E
LTP/FTP Ellipsoidal Height (metres)	124.9
FPAP Latitude	451227.4075N
Delta FPAP Latitude (seconds)	-64.9535
FPAP Longitude	0143448.7030E
Delta FPAP Longitude (seconds)	67.5450
Threshold Crossing Height	52.0
TCH Units Selector	0 (feet)
Glidepath Angle (degrees)	3.00
Course Width (metres)	105.00
Length Offset (metres)	0
HAL (metres)	40.0
VAL (metres)	50.0

Output data

Data Block	10 09 12 04 0C 0E 00 00 01 34 31 05 92 A3 6B 13 4C C4 3F 06 E1 18 8D 04 FB B2 0F 02 08 02 2C 01 64 00 C8 FA 1E 38 B9 AC
Calculated CRC Value	1E38B9AC

Required Additional Data

ICAO Code	LD
LTP/FTP Orthometric Height (metres)	80.6

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LDRI AD 2.24.12 IAC RNAV (GNSS) RWY 32 -2
Validity: 12 SEP 2019 - UFN

This IF procedure shall be used
for flight validation purposes only.

AIP HRVATSKA
AIP CROATIA

RUEKA / Krk I.
CROATIA
RNAV (GNSS) RWY 32

Input data

Operation Type	0
SBAS Provider	1 (EGNOS)
Airport Identifier	LDRI
Runway	32
Runway Letter	0 (None)
Approach Performance Designator	0
Route Indicator	
Reference Path Data Selector	0
Reference Path Identifier	E32A
LTP/FTP Latitude	451227.4075N
LTP/FTP Longitude	0143448.7030E
LTP/FTP Ellipsoidal Height (metres)	119.1
FPAP Latitude	451332.3610N
Delta FPAP Latitude (seconds)	64.9535
FPAP Longitude	0143341.1580E
Delta FPAP Longitude (seconds)	-67.5450
Threshold Crossing Height	50.0
TCH Units Selector	0 (feet)
Glidepath Angle (degrees)	3.00
Course Width (metres)	105.00
Length Offset (metres)	0
HAL (metres)	40.0
VAL (metres)	50.0

Output data

Data Block	10 09 12 04 0C 20 00 00 01 32 33 05 1F A8 66 13 FB D3 41 06 A7 18 73 FB 01 4E F0 FD F4 01 2C 01 64 00 C8 FA 17 74 39 4A
Calculated CRC Value	1774394A

Required Additional Data

ICAO Code	LD
LTP/FTP Orthometric Height (metres)	75.0

AIP SUP 011/2019

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CHANGE: New chart



Thank you for your attention

Questions?



A STAR ALLIANCE MEMBER



Davor Mišić

Chief pilot DASH-8 Q400

Croatia Airlines

CROATIA AIRLINES

- ❖ state-owned flag carrier
- ❖ this year Croatia Airlines is celebrating 30th anniversary
- ❖ fleet - consisting of 12 aircraft, 2 Airbus A-319 , 4 Airbus A-320 and 6 Dash 8 –Q400

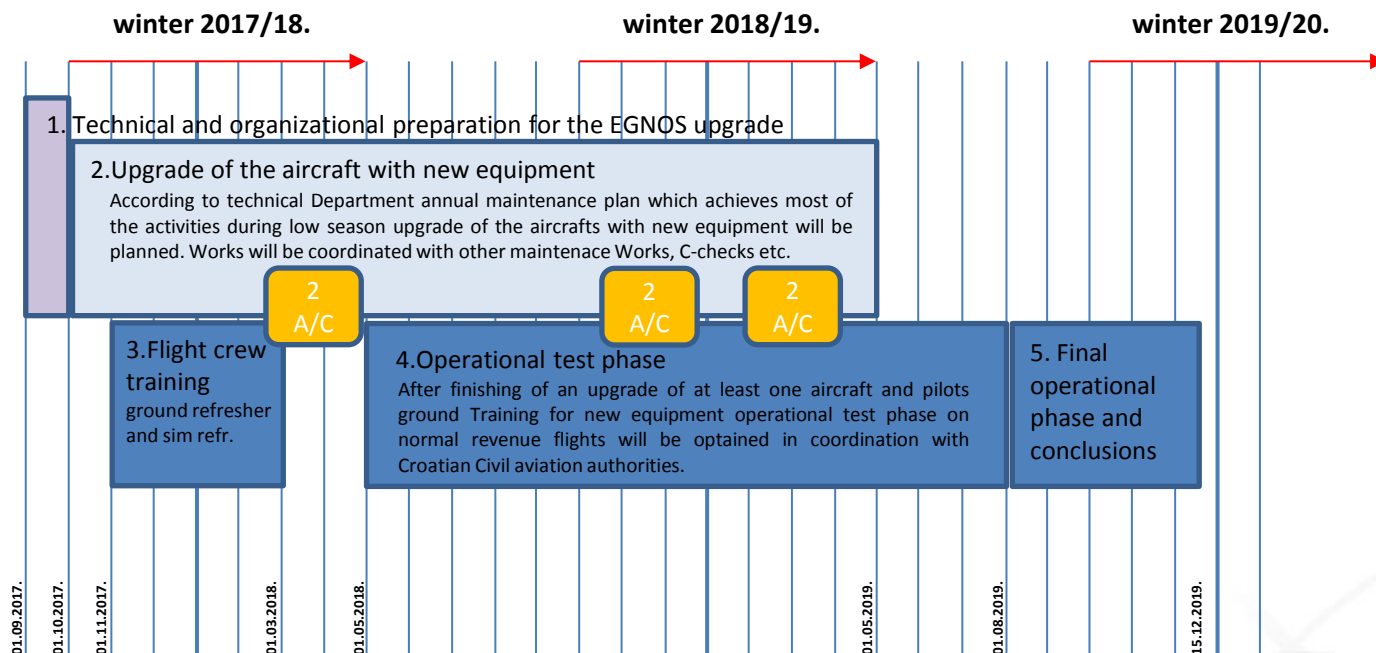


A STAR ALLIANCE MEMBER 

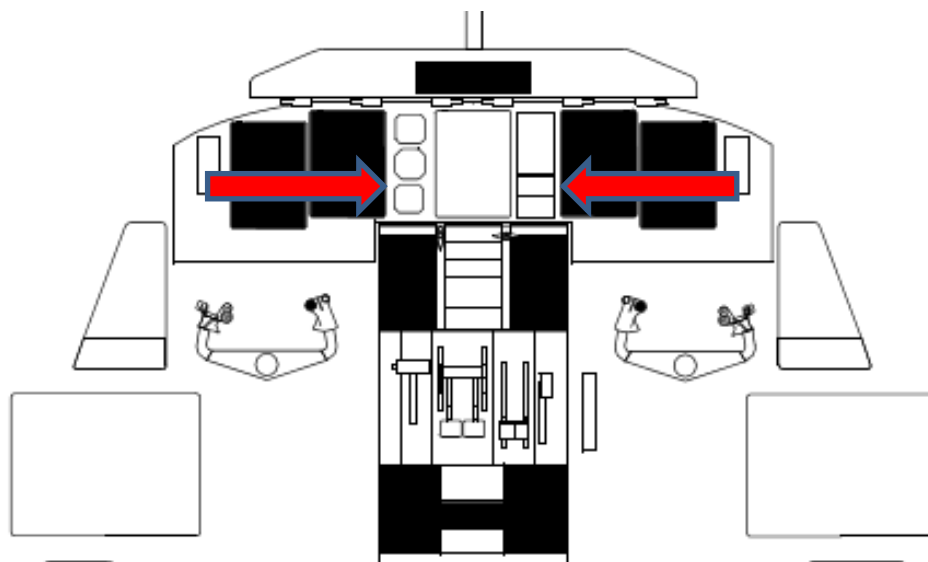
 CROATIA AIRLINES

LPV project

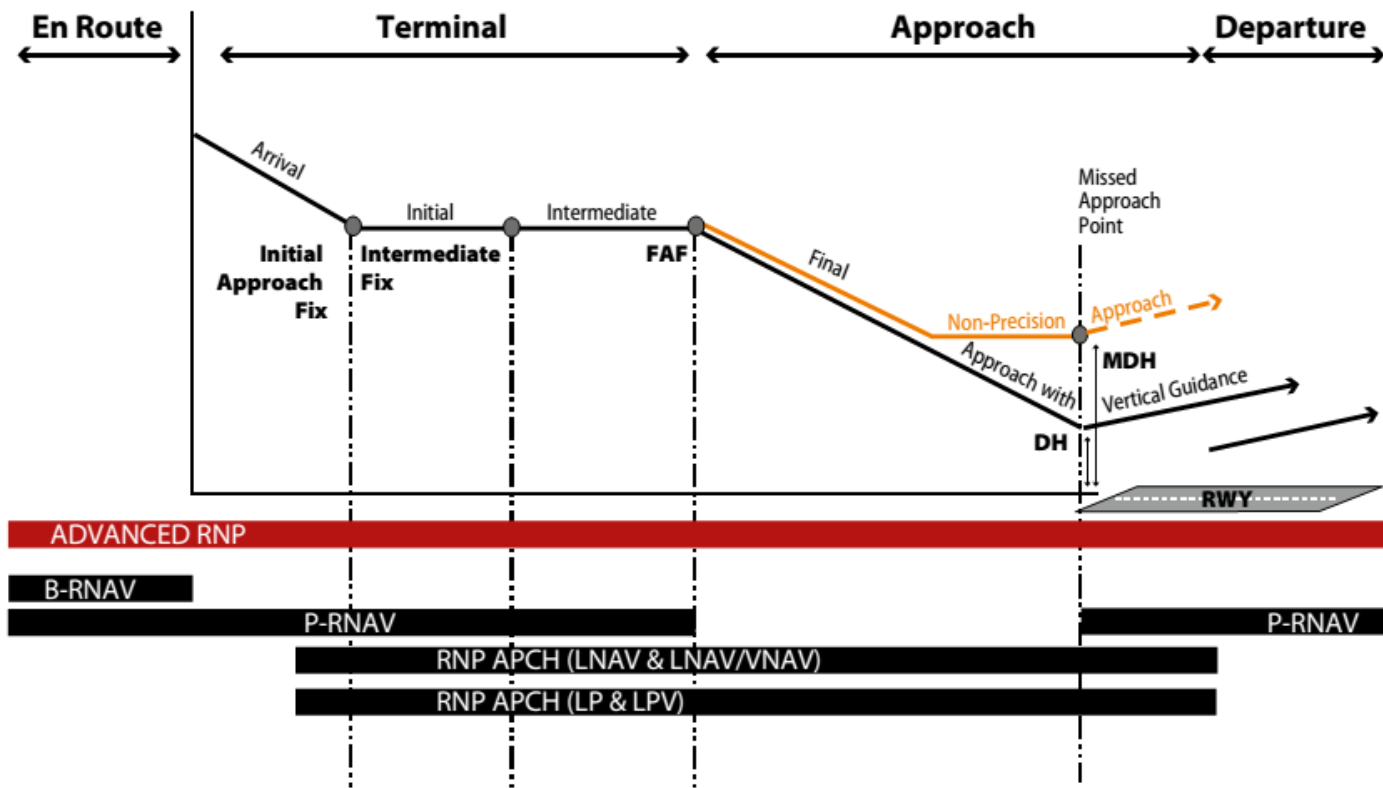
- ❖ recognized as future, modern aviation instrument approach
- ❖ modernization of Dash8 Q400 fleet, new FMS's installed
- ❖ Funding by EU (85%)
- ❖ introducing of complete new operation (LPV approach)
- ❖ low training costs according EASA AMC 20-27 (RNP APCH) and EASA AMC 20-28 (LPV)
- ❖ more reliable and stable operation



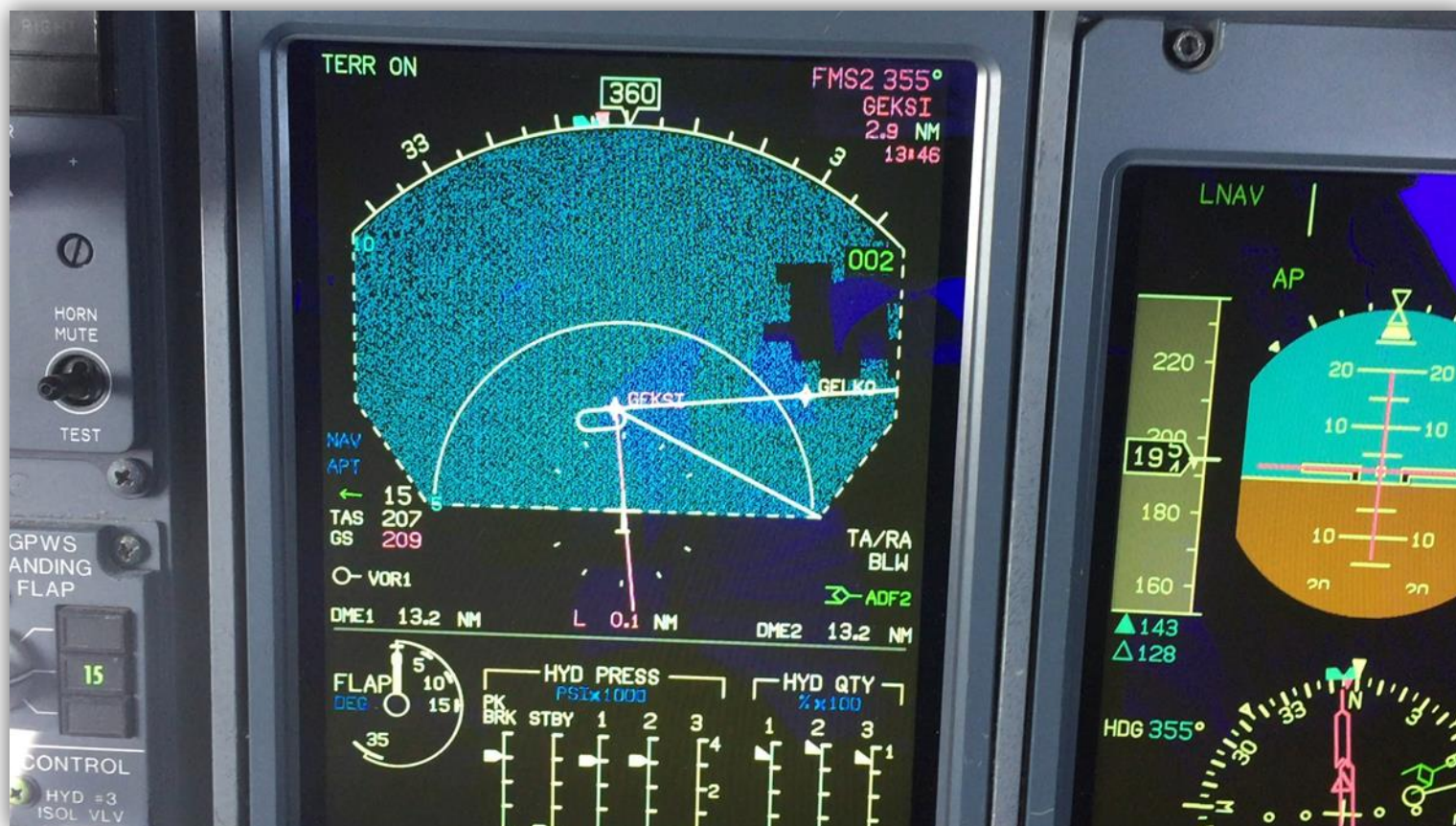
NEW!!! STC - LOS (Level of Service) Annunciator in the cockpit



“LOS annunciators are necessary when installing LP/LPV capable FMS. The LPV/LNAV/VNAV and LNAV only approach LOS must be annunciated from FMS.”



■ Pula LPV approach runway 09



Plans for future

- ❖ **RNP AR APCH** according EASA AMC 20-26 – new approval (RF LEG/IRS STC and FMS STC connection if needed)



QUESTIONS?

Thank you for your attention

Questions?