HELLENIC REPUBLIC
MINISTRY OF INFRASTRUCTURE AND TRANSPORT

AIR ACCIDENT INVESTIGATION AND AVIATION SAFETY BOARD (AAIASB)

SERIOUS INCIDENT INVESTIGATION REPORT

AIRCRAFT D-AICD AIRBUS A320-212
IN THE CTR OF KAVALA AIRPORT
ON AUGUST 16, 2018

E02 / 2021

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Serious incident of Aircraft D-AICD in the Airspace of Kavala Airport on August 16, 2018

This serious incident investigation was carried out by the Air Accident Investigation and Aviation Safety Board (AAIASB) according to:

- **Annex 13 of the Chicago Convention**
- **EU regulation (EU) 996/2010**
- **Law 2912/2001**

According to Annex 13 of the Chicago Convention of the International Civil Aviation, EU Regulation 996/2010 and Law 2912/2001, Accidents and Incidents Investigation is not intended to attribute blame or liability. The sole purpose of this investigation and the findings is to prevent accidents and incidents.

Therefore, the use of this report for any purpose other than to prevent future accidents and incidents could lead to misinterpretations.

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Contents List

List of abbreviations

ACCREP	Accredited Representative
ASL	Above Sea Level
ATC	Air Traffic Control
ATZ	Aerodrome Traffic Zone
CM1	Captain
CM2	First Officer
CPA	Closest Point of Approach
CTR	Controlled Traffic Region
CVR	Cockpit Voice Recorder
EGPWS	Enhanced Ground Proximity Warning Systems
EWD	Engine Warning Display
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FDM	Flight Data Monitoring
FDR	Flight Data Recorder
GPWS	Ground Proximity Warning System
HCAA	Hellenic Civil Aviation Authority
IAS	Indicated Air Speed
IFR	Instrument Flight Rules
METAR	Meteorological Terminal Air Report
MSL	Mean Sea Level
OTT	Operation Training Transmission
PF	Pilot Flying
PM	Pilot Monitoring

QAR	Quick Access Recorder
RA	Resolution Advisory
R/W	Runway
SID	Standard Instrument Departure
SOP	Standard Operating Procedure
SQUAWK	Select Transponder Code
TA	Traffic Alert
TAU	Time to intercept
TCAS	Traffic Collision Avoidance System
TOGA	Take Off Go Around
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
V/S	Vertical Speed
VSI	Vertical Speed Indicator

TITLE

OPERATOR	CONDOR FLUGDIENST GmbH
OWNER	UNICREDIT LEASING AVIATION GmbH
MANUFACTURER	AIRBUS SAS
A/C TYPE	A320-212
COUNTRY OF CONSTRUCTIONN	FRANCE
NATIONALITY	GERMANY
REGISTRATION	D-AICD
LOCATION OF SERIOUS INCIDENT	Kavala Airport CTR
DATE & TIME	Thursday August 16, 2018 at 10:07:49 LT
Note	All times are UTC except when specified. (LT = UTC + 3h)

SYNOPSIS

On 16/08/2018, the Aircraft owned by "UNICREDIT LEASING AVIATION GmbH" and operated by the "CONDOR FLUGDIENST GmbH" with registration D-AICD, took off from Kavala Airport (LGKV) with flight number DE 1744 destination Munich International Airport (EDDM).

While performing a visual departure from R/W 23L in the direction of XERIS, the Crew received a TCAS (TA, RA) during initial climb and manoeuvre to avoid a possible collision with a Helicopter passing through the CTR of Kavala Airport and then performed a manoeuvre to avoid a mountain mass. The Aircraft then resumed its flight and landed at its final destination. The Air Accident Investigation and Aviation Safety Board was informed and with the AAIASB / 2812 / 20.08.2018 document an investigation team was appointed, while the operating state and the state of construction of the Aircraft, appointed an accredited representative (ACCREP) and technical consultant (TECHNICAL ADVISER) respectively.

Sequence of events

06:50:16 h: Engine start up and ATC clearance.
06:50:51 h: the flight Crew requested a visual departure, the visual departure was granted.
06:57:59 h: First communication of the Helicopter, registration SX-HDW, with Kavala ATC.
06:58:13 h: Second communication of the Helicopter, registration SX-HDW, with Kavala ATC.
07:07:00 h: D-AICD was cleared for take-off from runway 23L.
07:08:23 h: At an altitude of 1000 ft D-AICD communicate to ATC the right turn.
07:08:40 h: ATC reported *"Continue visually in the direction of XERIS point.*
07:09:43 h: At 2,650 ft TCAS TA ‘’TRAFFIC-TRAFFIC’’.
07:09:51 h: At 2,700 ft the TCAS commanded ‘’MAINTAIN V/S’’
07:09:54 h: TCAS, command ''DESCEND’’
07:09:58 h: First 'Dual input condition'.
07:10:02 h: At 2,740 ft, the TCAS RA ‘’INCREASE DESCEND’’
07:10:06 h: Closest distance vertical being 109 ft and horizontal of 0.09 NM (167 m).
07:10:12 h: At 2,414 ft, the caution “TERRAIN AHEAD”.
07:10:20 h: End of 'Dual input condition'.
07:10:25 h: D-AICD declared ‘’NOW CLEARED OF TRAFFIC’’.

1 FACTUAL INFORMATION

1.1. History of Flight

According to the recording of communications between the Flight Crew and the Controller of Kavala Airport, at 06:50:16 h approval was given for engines start up and ATC clearance for destination Airport Munich (EDDM), with climb to FL200, following XERIS 1C departure, exit point EVIVI and SQUAWK 1752.

At 06:50:51 h the flight Crew requested a visual departure, the visual departure was granted.

At 07:07:00 h D-AICD was cleared for take-off from runway 23L.

At 07:08:23 h at an altitude of 1000 ft the Flight Crew contacted ATC stating *"Condor 3DC we are turning inbound PEREN".*

At 07:08:40 h ATC reported *"Continue visually in the direction of XERIS point climbing to FL240 and report again when passing through FL140",* the clearance was confirmed by the Captain as PM at 07:08:50 h. (Fig. 1)

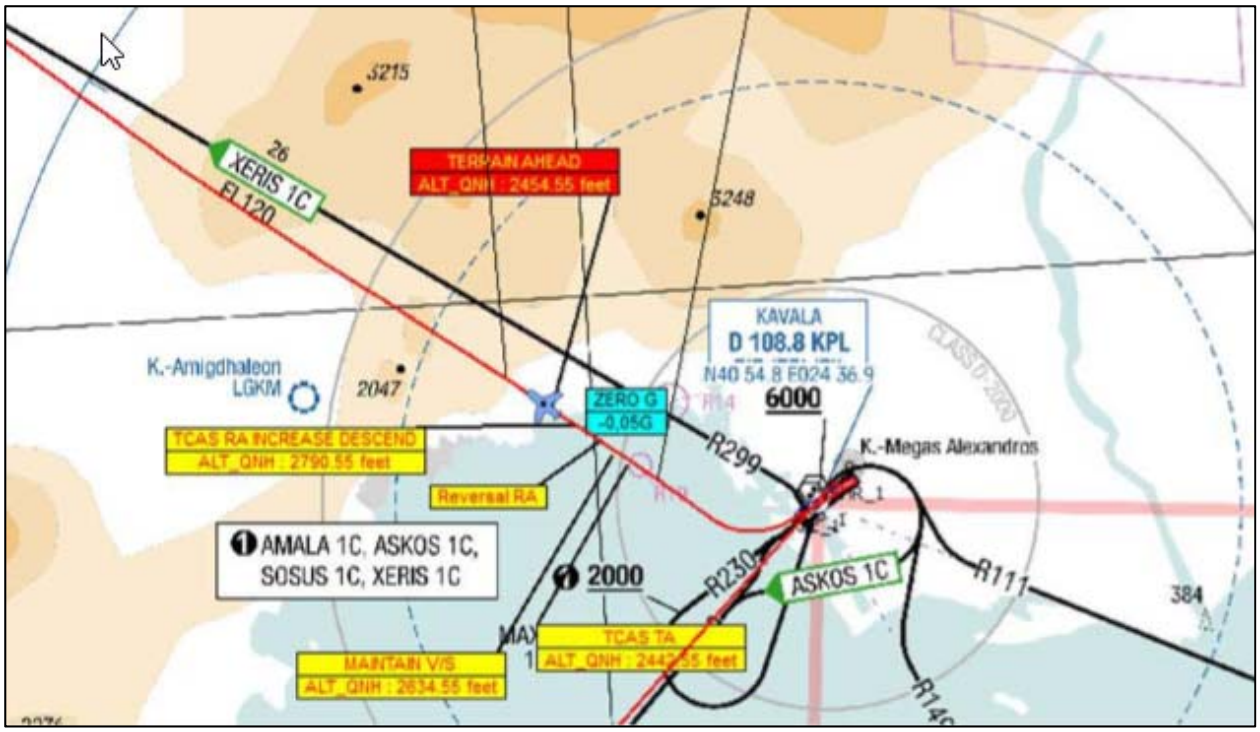


Fig. 1: Illustration of XERIS 1C SID of Kavala Airport and the red line is the track of D-AICD.

From the interviews taken from the Flight Crew and conducted by the Operator, immediately after the flight, the First Officer (CM2), who was the ΄PF΄, stated that he saw an *intruder* symbol on his ND immediately after the right turn, recognizing a vertical separation of +300 ft and

informed the Captain (CM1) performing ´PM´ duties. (CM1) saw the Aircraft symbol in his ND without recognizing whether it was above or below. The two Pilots tried to make eye contact with the *intruder* without success, while the Aircraft was still climbing at 150 kts IAS with landing lights on according SOP.

At 07:09:43 h, with D-AICD at an altitude of 2,650 ft, a potential threat TCAS TA 'TRAFFIC-TRAFFIC' was heard and (CM1) reduced his navigation ND display to 10 NM range, as described in the FCOM and the CONDOR Flight Crew Training Manual. (Fig. 2)

Fig. 2: ND display at the TCAS TA “TRAFIC-TRAFIC”.

According to the Crew interview, immediately after the TCAS TA, the (CM2) declared *‘TCAS, I HAVE CONTROL’ according to SOP*.

At 7:09:44 h and at 2,650 ft the PF, having seen the potential traffic on his ND at +300 ft started a pitch down movement on his side stick. With the result of reducing the rate of climb from +1600 ft/min to +500 ft/min with an IAS at 240 to 245 kts.

Seven secs later at 07:09:51h and at attitude of 2,700 ft the TCAS having detected the reduction in rate of climb, commanded ‘’MAINTAIN V/S’’ while the crew during the interview stated that they heard an audible warning for a climb. (Fig.3)

Fig. 3: ND/PFD display at the TCAS TA “MAINTAUN V/S”.

At the ‘’MAINTAIN V/S’’ command, the PF started to pitch up again.

At 07:09:54h TCAS, detecting both traffic at approximately the same altitude, reversed its command to ''DESCEND’’.

As the PF was in pitch up and the command now being ''DESCEND’’ the V/S never reached the green band as in the first 3.5 sec the Aircraft accepted ‘nose down command’ and so an average deviation of -1.02 ° (nose up command direction) appeared on the co-Pilot side stick. At the same time, we observed that (CM1) did not interfere with the side stick. (Fig. 4)

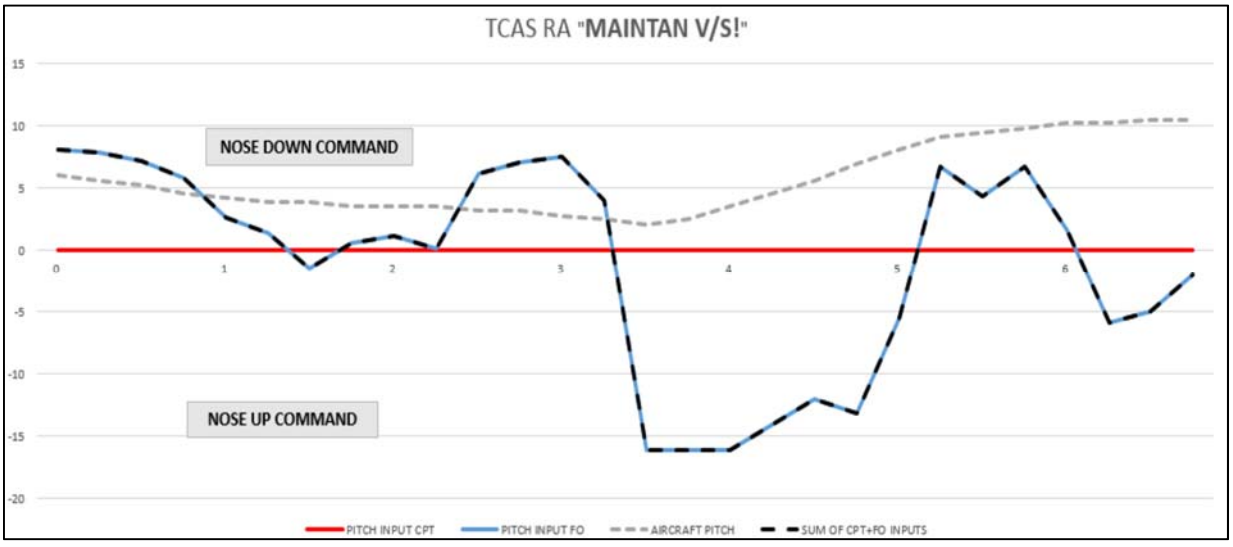


Fig. 4: Projection of the Aircraft in combination with the deviation of the controls of both Pilots in the ‘MAINTAIN V/S’ phase.

As mentioned above, at 07:09:58 h and while the Aircraft was at 2,770 ft, the indication 'TCAS RA' changed to 'DESCEND ' (Reversal RA) urging the Crew to achieve a V/S of -1500 ft / min within 2, 5 sec. The vertical speed at the time of that incident was +600 ft / min, so the change in V/S would have to be -2,100 ft / min within 2.5 sec in order to be in the green band of the VSI and meet the requirement of the 'TCAS RA'.

The (CM1) recalled saying 'Descend, Descend' giving 'nose down command' twice to increase the negative vertical speed, by pushing the sidestick forward for the next few seconds, without having previously followed the 'Take over control', according to SOP, by declaring “I have Control”.

The sum of commands on both sidesticks resulted in a decrease in Aircraft pitch and an increase in descent V/S. However, after 3 sec (CM2), having not realizing the actions of the (CM1), gave 'nose up command' because of the strange feeling he had by the reaction of the Aircraft, not knowing that (CM1) was operating on the sidestick although the “Dual Input” alerted both Pilots. Thus, by (CM1) imposing + 2.16 ° 'nose down command' on the sidestick and (CM2) a + 0.07 ° 'nose up command', with the result that the sum was + 2.09 ° (nose down command). (Fig. 5)

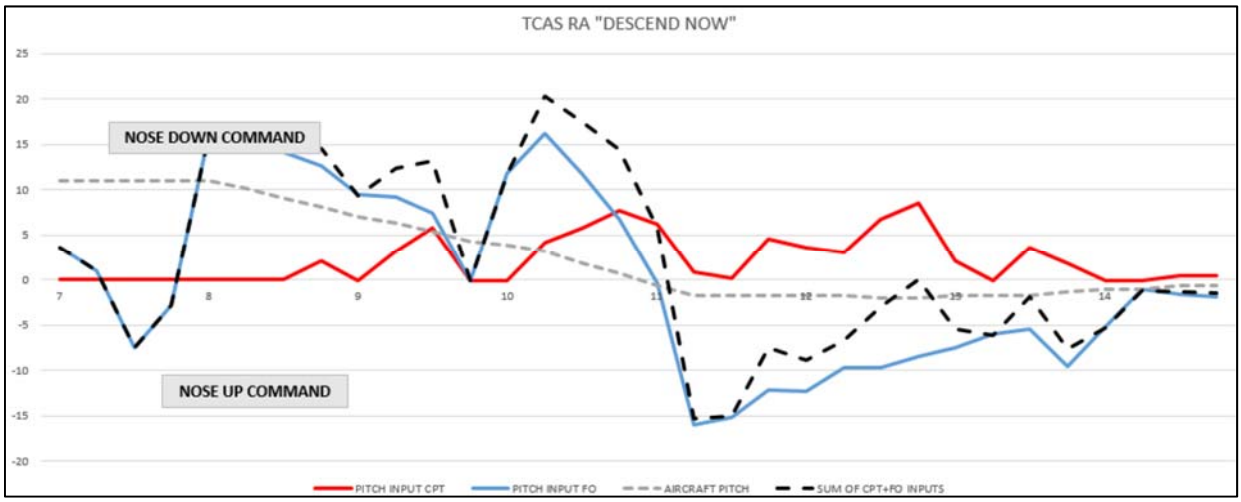


Fig. 5: Aircraft pitch in combination with the deviation of both sidesticks in the ‘DESCEND NOW’ phase.

During the above reaction of both Pilots, the Aircraft sustained a ‘G-Load’ -0.05 without reaching the green band of the VSI.

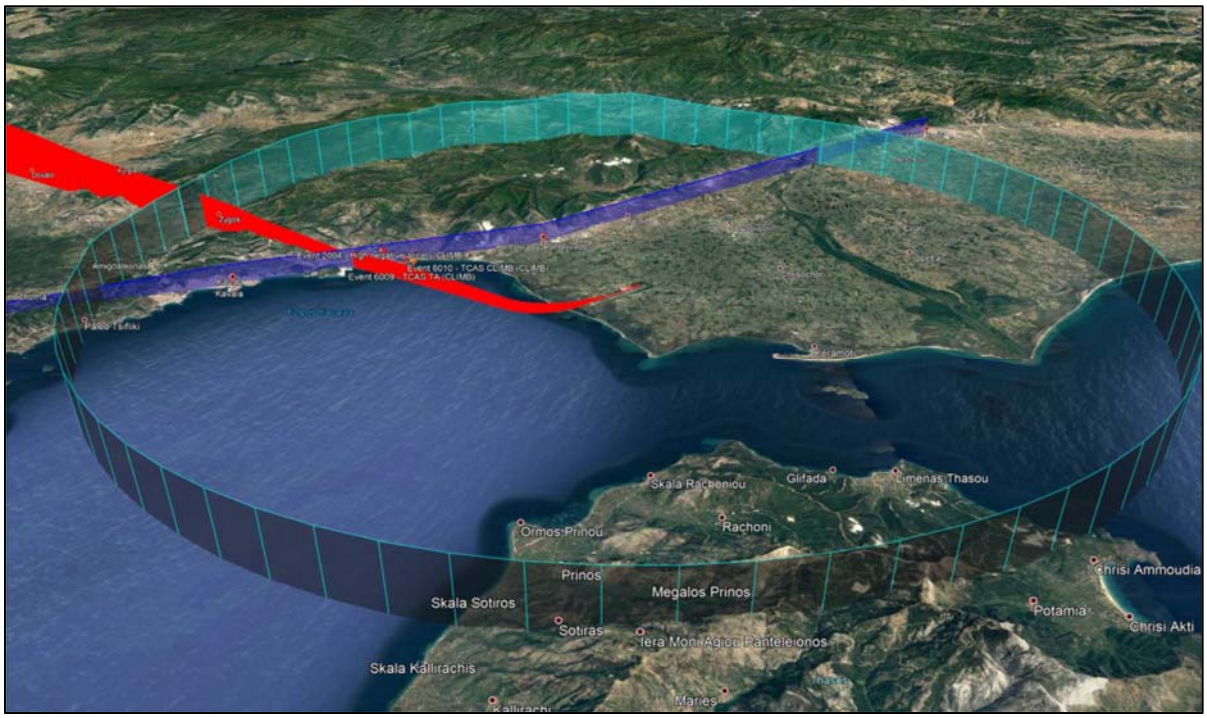


Fig. 6: Blue track of the intruder that crossed the red track of D-AICD**.**

At 07:10:02 h and an altitude of 2,740 ft, the TCAS RA 'INCREASE DESCEND' command was activated when the Aircraft had a descent V/S of -600 ft / min. The incoming intruder was steadily at an altitude of 2,869 ft and remained there throughout the incident. The vertical distance between the two Aircraft was 109 ft and the distance between both A/Cs was 0.4 NM (741 m), while the vertical speed was not in the green band in the initial stage of the TCAS RA 'INCREASE DESCEND'.

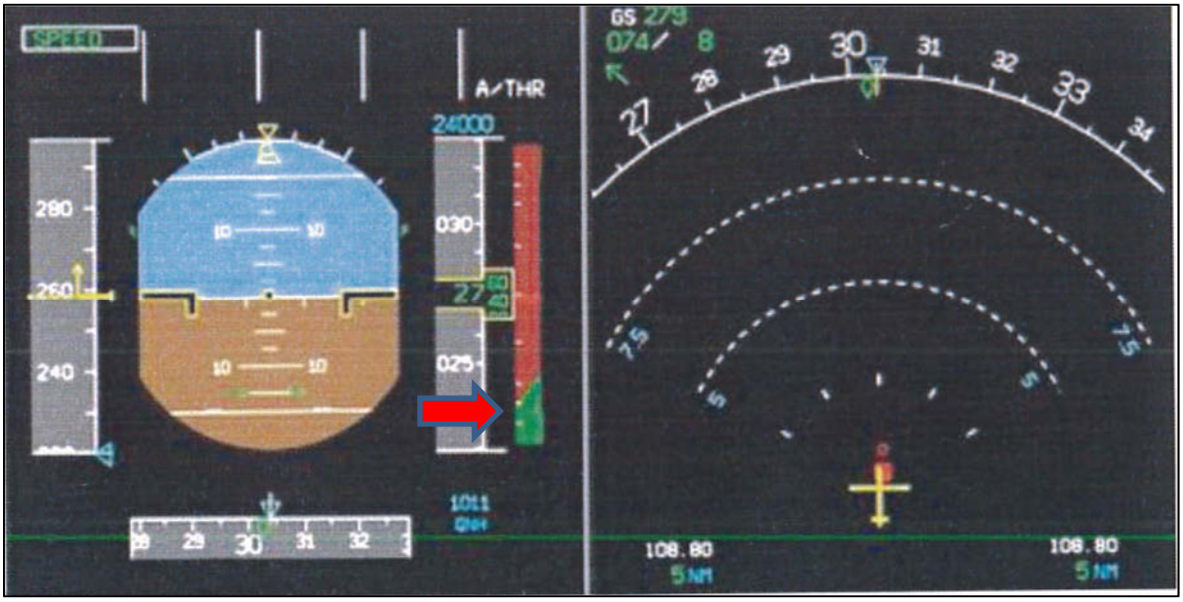


Fig. 7: ND/PFD display at the TCAS TA "INCREASE DESCENT".

After 4 sec, at 07:10:06 h, the closest distance between both A/Cs was recorded, with the vertical being 208 ft and horizontal of 0.09 NM (167 m).

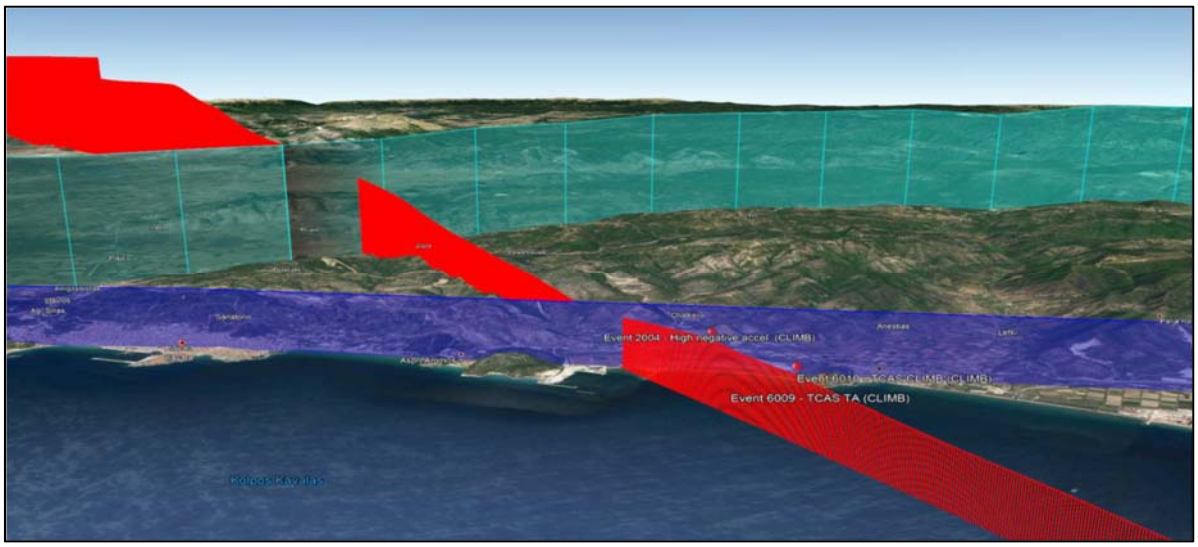


Fig. 8: Detail of the time at which the intersection took place of the two tracks in the course of the involved aircraft.

When the TCAS RA 'INCREASE DESCEND' was activated, commanding a higher negative V/S, (CM2) first gave 'nose up command' for 2 sec and then 'nose down command', while (CM1) in turn gave 'nose down command', without having previously followed the procedure of 'Takeover control' according to SOP thus leading to a high 'nose down command', with a sum of + 17.9 °nose down command.

The above high ‘nose down command’ gave a high negative ‘G-Load’ which led (CM2) to give a ‘nose up command’ again. (CM2) as he stated in his testimony, was not aware of action given by (CM1) to the sidestick and for this reason he wondered about the high negative pitch of the aircraft after his own 'nose down command' having the feeling that the result was different than expected after his own command on the sidestick. Also, neither Pilots could remember whether the “Dual Input” indicator light on the controls and aural warning were activated. FDM did not provide relevant records for the “Takeover Pushbutton”.

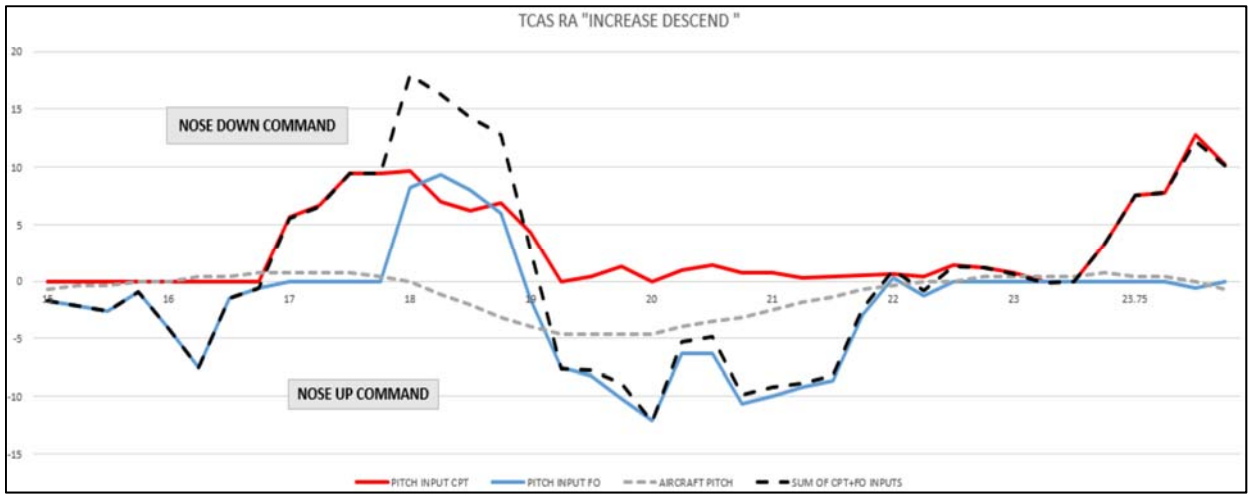


Fig. 9: Pitch of the Aircraft in combination with the deviation of both sidesticks in the "INCREASE DESCEND" phase.

Fig. 10: PFD και ND screens at the time of RA "INCREASE DESCEND".

The average of commands on the sidesticks during 'INCREASE DESCEND' was for (CM1) + 2.95 ° 'nose down command', for (CM2) - 2.14 ° 'nose up command' and the sum of the commands of the two Crew members was + 0.81 ° 'nose down command'. The average of (CM1) commands was higher than (CM2) so the sum of the commands was a 'nose down command' during TCAS RA 'INCREASE DESCEND'.

At 07:10:12 h at an altitude of 2,414 ft, the caution aural warning "TERRAIN AHEAD" was heard.

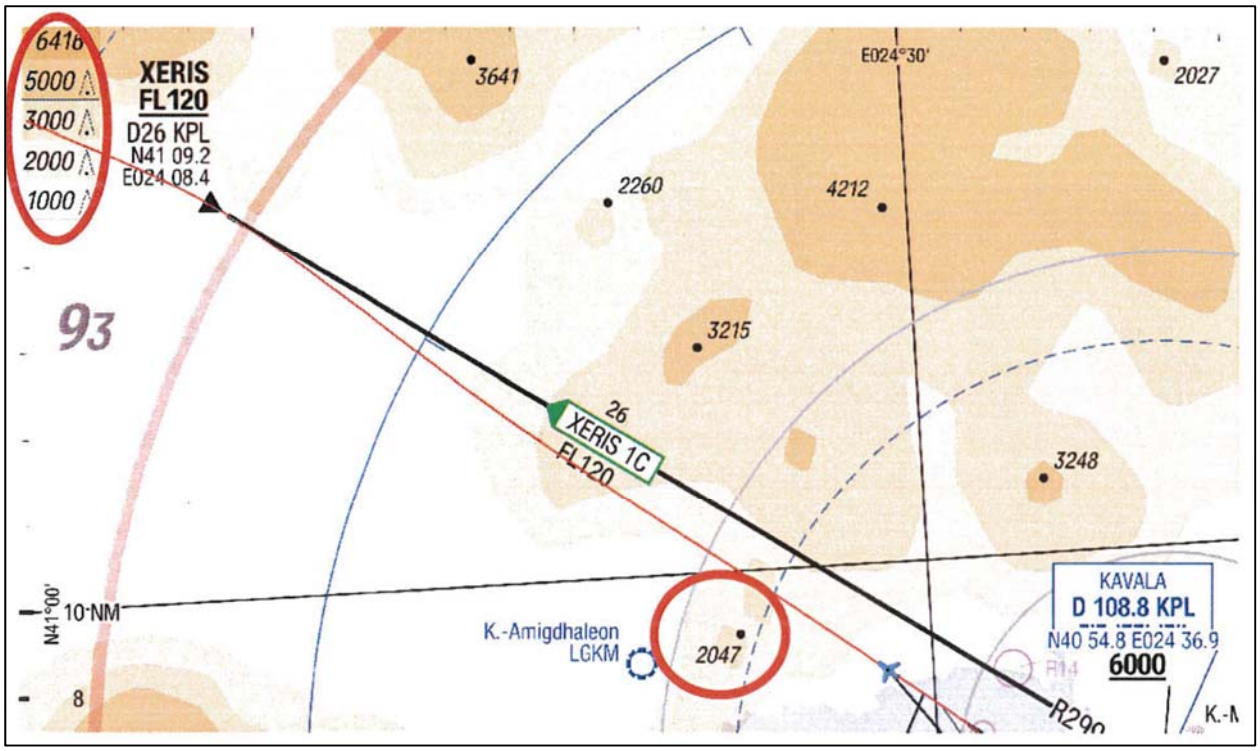


Fig. 11: Terrain ahead on LIDO Chart.

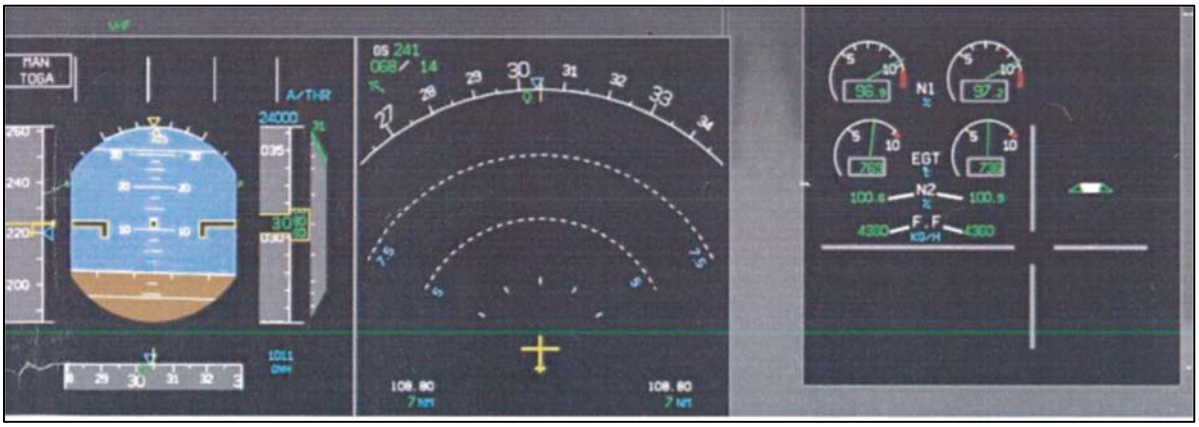


Fig. 12: PFD / ND and EWD at time of terrain caution

#01/08/2018 Time	ALT_QNH (feet)	TCAS_TA_2	VRTG (g)	NM_RANGE_CA	PITCH (deg)	PITCH_CPT (deg)	PITCH_FO (deg)	FD_2	FD_1	IVV (ft/min)	TCAS_DWN_ADV	TCAS_UP_ADV	TCAS_VRT_CTL	RALTC (feet)	GPWS
07:09:34	2274.55	No TA Dger	1.10		8.4	0.0	1.1	ENGAGED	ENGAGED	982	No Adv	No Adv	No Adv	2431	
07:09:35	2302.55	No TA Dger	0.96		8.1	0.0	2.5	ENGAGED	ENGAGED	974	No Adv	No Adv	No Adv	2431	
07:09:36	2346.55	No TA Dger	0.92		7.7	0.0	2.6	ENGAGED	ENGAGED	1088	No Adv	No Adv	No Adv	2493	
07:09:37	2362.55	No TA Dger	0.90	20 NM	7.4	0.0	-1.0	ENGAGED	ENGAGED	1442	No Adv	No Adv	No Adv	2493	
07:09:38	2382.55	No TA Dger	0.92		7.4	0.0	-2.0	ENGAGED	ENGAGED	1560	No Adv	No Adv	No Adv	2536	
07:09:39	2398.55	No TA Dger	1.04		7.7	0.0	0.0	ENGAGED	ENGAGED	1402	No Adv	No Adv	No Adv	2536	
07:09:40	2442.55	No TA Dger	0.94		7.7	0.0	-3.3	ENGAGED	ENGAGED	1296	No Adv	No Adv	No Adv	2589	
07:09:41	2466.55	No TA Dger	0.98	20 NM	8.1	0.0	-0.1	ENGAGED	ENGAGED	1462	No Adv	No Adv	No Adv	2589	
07:09:42	2486.55	No TA Dger	1.04		8.4	0.0	-0.7	ENGAGED	ENGAGED	1653	No Adv	No Adv	No Adv	2647	
07:09:43	2510.55	TA Danger	0.98		8.4	0.0	-4.2	ENGAGED	ENGAGED	1543	No Adv	No Adv	No Adv	2647	
07:09:44	2566.55	TA Danger	0.98		8.8	0.0	5.4	ENGAGED	ENGAGED	1469	No Adv	No Adv	No Adv	2717	
07:09:45	2590.55	TA Danger	0.86	10 NM	7.7	0.0	4.0	ENGAGED	ENGAGED	1776	No Adv	No Adv	No Adv	2717	
07:09:46	2614.55	TA Danger	0.80		6.7	0.0	2.1	ENGAGED	ENGAGED	1982	No Adv	No Adv	No Adv	2774	
07:09:47	2634.55	TA Danger	0.80		6.0	0.0	8.1	ENGAGED	ENGAGED	1803	No Adv	Climb	Maintain	2774	
07:09:48	2662.55	No TA Dger	0.68		4.2	0.0	2.6	ENGAGED	ENGAGED	1644	No Adv	Climb	Maintain	2828	
07:09:49	2670.55	No TA Dger	0.75	10 NM	3.5	0.0	1.1	ENGAGED	ENGAGED	1577	No Adv	Climb	Maintain	2828	
07:09:50	2678.55	No TA Dger	0.73		2.8	0.0	7.6	ENGAGED	ENGAGED	1413	No Adv	Climb	Maintain	2861	
07:09:51	2666.55	No TA Dger	0.90		3.5	0.0	-16.2	ENGAGED	ENGAGED	1105	No Adv	Climb	Maintain	2861	
07:09:52	2678.55	No TA Dger	1.52		8.1	0.0	-5.5	ENGAGED	ENGAGED	701	No Adv	Climb	Maintain	2862	
07:09:53	2698.55	No TA Dger	1.50	10 NM	10.2	0.0	1.6	ENGAGED	ENGAGED	469	No Adv	Climb	Maintain	2862	
07:09:54	2730.55	No TA Dger	1.38		10.9	0.0	3.6	ENGAGED	ENGAGED	631	Descend	No Adv	Reversal	2912	
07:09:55	2770.55	No TA Dger	1.17		10.9	0.0	16.1	ENGAGED	-	938	Descend	No Adv	No Adv	2912	
07:09:56	2854.55	No TA Dger	0.58		7.0	-0.2	9.5	-	-	1341	Descend	No Adv	No Adv	3003	
07:09:57	2874.55	No TA Dger	0.32	10 NM	3.9	-0.1	11.8	-	-	2126	Descend	No Adv	No Adv	3003	
07:09:58	2886.55	No TA Dger	0.04		-0.7	6.2	-0.4	-	-	2454	Descend	No Adv	No Adv	3073	
07:09:59	2866.55	No TA Dger	0.37		-1.8	3.5	-12.4	-	-	1961	Descend	No Adv	No Adv	3073	
07:10:00	2822.55	No TA Dger	0.65		-1.8	2.1	-7.6	-	-	1235	Descend	No Adv	No Adv	3050	
07:10:01	2790.55	No TA Dger	0.91	10 NM	-1.1	-0.1	-5.2	-	-	194	Descend	No Adv	No Adv	3050	
07:10:02	2762.55	No TA Dger	1.04		-0.7	0.0	-1.7	-	-	-623	Descend	No Adv	Increase	2987	
07:10:03	2734.55	No TA Dger	1.04		0.0	0.0	-4.2	-	-	-1011	Descend	No Adv	Increase	2987	
07:10:04	2694.55	No TA Dger	1.17		0.7	5.6	-0.1	-	-	-1232	Descend	No Adv	Increase	2926	
07:10:05	2674.55	No TA Dger	0.96	10 NM	0.0	9.7	8.3	-	-	-1499	Descend	No Adv	Increase	2926	
07:10:06	2650.55	No TA Dger	0.41		-3.9	4.3	-1.6	-	-	-1598	Descend	No Adv	Increase	2885	
07:10:07	2606.55	No TA Dger	0.62		-4.6	-0.1	-12.1	-	-	-1506	Descend	No Adv	Increase	2885	
07:10:08	2526.55	No TA Dger	1.04		-2.5	0.8	-10.0	-	-	-1682	Descend	No Adv	Increase	2799	
07:10:09	2494.55	No TA Dger	1.32	10 NM	-0.4	0.6	0.4	-	-	-2355	Descend	No Adv	Increase	2799	
07:10:10	2470.55	No TA Dger	1.25		0.4	0.7	-0.1	-	-	-2687	Descend	No Adv	Increase	2719	
07:10:11	2454.55	No TA Dger	1.12		0.4	7.6	0.0	-	-	-2354	Descend	No Adv	Increase	2719	
07:10:12	2414.55	TA Danger	0.84		-1.1	9.8	-0.1	-	-	-1973	Not Used	Not Used	Not Used	2641	WARNING
07:10:13	2378.55	TA Danger	0.61	10 NM	-3.2	6.9	-10.3	-	-	-1877	No Adv	No Adv	No Adv	2641	WARNING
07:10:14	2346.55	TA Danger	1.13		-0.4	-10.9	-9.4	-	-	-2010	Not Used	Not Used	Not Used	2596	WARNING
07:10:15	2318.55	TA Danger	1.60		3.9	-9.1	-5.5	-	-	-2020	No Adv	No Adv	No Adv	2596	WARNING
07:10:16	2322.55	TA Danger	1.77		7.4	-6.2	1.1	-	-	-1947	No Adv	No Adv	No Adv	2612	WARNING
07:10:17	2338.55	TA Danger	1.66	10 NM	10.2	-11.5	5.1	-	-	-1542	Not Used	Not Used	Not Used	2612	
07:10:18	2370.55	TA Danger	1.70		13.0	-2.4	6.6	-	-	-835	No Adv	No Adv	No Adv	2529	
07:10:19	2418.55	TA Danger	1.43		13.7	3.2	3.3	-	-	-84	Not Used	Not Used	Not Used	2529	
07:10:20	2538.55	No TA Dger	1.02		13.0	-1.5	0.0	-	-	735	Not Used	Not Used	Not Used	2661	
07:10:21	2594.55	No TA Dger	0.83	10 NM	12.3	3.4	0.0	-	-	2156	No Adv	No Adv	No Adv	2661	
07:10:22	2646.55	No TA Dger	0.85		12.0	0.0	0.0	-	-	3187	Not Used	Not Used	Not Used	2803	
07:10:23	2698.55	No TA Dger	0.86		12.0	-0.4	0.0	-	-	3204	No Adv	No Adv	No Adv	2803	
07:10:24	2794.55	No TA Dger	0.96		12.0	-0.3	0.0	-	-	3177	No Adv	No Adv	No Adv	2899	
07:10:25	2838.55	No TA Dger	0.93	10 NM	12.3	0.0	0.0	-	-	3593	Not Used	Not Used	Not Used	2899	

Fig. 13: Timely presentation of TCAS readings.

The Aircraft was climbing in a north-westerly direction at a V/S of 1.973 ft / min towards higher mountain volumes of 3,000 ft and with a higher obstacle at 2,047 ft.

(CM1) according to the interview, immediately after declaring “I HAVE CONTROL” performed an ascent with a pitch angle greater than 11° with TOGA thrust and vertical speed of +3.000 ft / min. The Aircraft during climb, suffered a ‘G-Load’ +1.77g.

(CM1) did not remember pressing the ‘Takeover pushbutton’, but FDM also had no relevant records for ‘Takeover pushbutton’. However, 7 seconds after GPWS activation, there are no records of operation from (CM2) on his sidestick possibly due to pressure on the 'Takeover

pushbutton' by (CM1) or non-intervention of (CM2) on his sidestick after listening to 'I HAVE CONTROL 'as he stated in his interview. From the recordings however, it appears that (CM2) in the first 4 sec made corrective actions with his sidestick and in the next 3 sec gave a small ‘nose down command’.

From 07:10:20 h, there are no more records for (CM2) commands on his sidestick and this was the first time that the meaning of ΄PF΄ becomes clear after the first 'Dual input condition' at 07:09:58 h (22 sec duration of uncertain control status of the Aircraft). (Fig. 14)

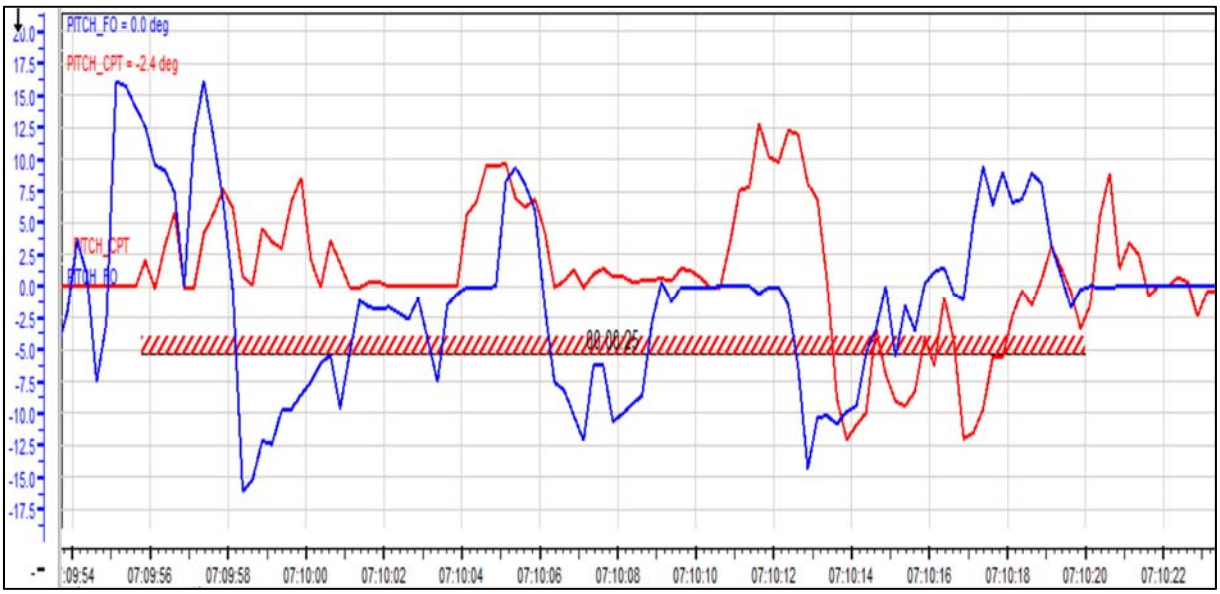


Fig. 14: Snapshots from the simultaneous operation of the sidesticks from both Pilots during the incident.

At time 07:10:25 h, D-AICD according to Kavala ATC, declared ‘’NOW CLEARED OF TRAFFIC’’. A similar conversation was recorded time 07:10:49 h, when the Aircraft continued its course to its final destination.

According to the transcript of the conversations of ATC Kavala, at 06:57:59 h, we have the first communication of the Pilot of the SX-HDW Helicopter with ATC Kavala and at 06:58:13 h, he states that he took off from Xanthi with destination Pontolivado, Kavala, Asprovalta, Panorama, with final destination Halastra Thessaloniki and flying at 2,500 ft. Then, when was asked by the ATC, what time he estimates Halastra Thessaloniki, the Helicopter Pilot answered in 1 h and 35 min. When was asked by the ATC, what time he estimates Asprovalta, the Pilot of the Helicopter at 07:09:04 h replied ‘’at 35’’.

At 07:10:22 h the Helicopter reports ‘Kavala the HDW’, while D-AICD at 07:10:25 h reports ‘Condor 3DC TCAS Alert. Now "cleared of traffic" and the ATC at 07:10:34 h reports ‘Maintain 2,000 feet sir’, without mentioning where it is addressed.

At 07:14:23 h the Aircraft reports ”Condor 3DC just for information, I do not know if you noticed, we had a TCAS RA” and the ATC then at 07:14:32 h reports “Yes madam, I have also coordinated with the Helicopter about this, for the TCAS RA”.

At 07:15:27 h the Helicopter reports “Kavala, we are Asprovalta 2,000”

An interview with the Helicopter Pilot was not possible, but a passenger of the Helicopter stated that while the Helicopter was in the area of Kavala Airport, they saw a large shadow under them and realized that it was a large Aircraft flying under the Helicopter in a lower altitude, with a downward course, which shortly before approaching the mainland took a sharp climb and continued its course.

1.2. Injuries to persons

No injuries were reported.

1.3. Damages to Aircraft

Not Applicable.

1.4. Other damages

Not Applicable.

1.5. Personnel information

1.5.1 D-AICD Flight Crew

The Captain (CM1) of the Aircraft was a Pilot 35-year-old. That Pilot had a total of 5,063 flight hours, of which 4,886 hours were on the Aircraft type and 1183:51 hours as Pilot in command. That Pilot had not flown the day before the incident, while the total flight hours for the month of August 2018 were 56:37 hours. That Pilot had a valid Licence and passed a medical examination on 23/02/2018. On the day of the incident, the Pilot presented for duty at 02:40 UTC in Munich which is the home base.

The First Officer (CM2) was a Pilot 33-year-old. That Pilot had a total of 1,033 flight hours, of which 682 hours were on A/C type. That Pilot had not flown 11 days before the incident, which included his normal leave, while his total flight hours for the month of August 2018 were 44:24 hours. He had a valid Licence and passed a medical examination on 29/05/2018. On the day of the incident he presented himself for duty in Munich at 02:40 UTC which is his home base.

1.5.2 Helicopter SX-HDW flight Crew

The Captain of the Helicopter was a gentleman 65-year-old. He had a total of 5,228 flight hours, of which 600 hours were on type. The day before the incident he had not flown and on the day of the incident he flew a total of 4 hours. Also, in the previous 7 days, he had flown 12 hours and in the previous month, he had flown 47 hours flight time. He had a valid Pilot's licence and a Medical Certificate Class 1 and Class 2 valid until 20/09/18 and 20/03/19 respectively.

1.6. Aircrafts Information

1.6.1 D-AICD Aircraft

Manufacturer	: AIRBUS SAS
Type	: A320-212
Serial Number (MSN)	: 884
Continuous Airworthiness Certificate	: Date of issue 11/09/2017
	: Expire date 30/09/2018.

1.6.2 SX-HDW Helicopter

Manufacturer	: HUGHES TOOL Co
Type	: 369HS
Serial Number (MSN)	: 1090207S
Continuous Airworthiness Certificate	: Date of issue 20/05/2018
	: Expire date 19/05/2019.

Fig. 15: Helicopter type same as SX-HDW.

1.7. Meteorological Information

The METAR received for that day at around 10:09 the prevailing weather for the region were:

201808160720 METAR LGKV 160720Z 23005KT CAVOK 28/18 Q1011=

201808160650 METAR LGKV 160650Z 23004KT CAVOK 27/18 Q1011=

South west winds of 4-5 knots, visibility over 10 km and no clouds below 5,000 ft.

1.8. AIDS to navigation

Not applicable.

1.9. Communications

The Communications, of D-AICD and SX-HDW with Kavala ATC, with no reported problems.

1.10. Aerodrome Information

Kavala Airport (LGKV) ALEXANDER THE GREAT, is located 30 km East of the city of Kavala. The Airport reference point has, in the centre of the runway 05R / 23L, coordinates 40 ° 54′50′′N and 024 ° 37′11′′E. The RW is 3,000 m long and 45 m wide.

The KAVALA ALEXANDER THE GREAT ATZ, covers the Airspace up to 2000 ft from the ground and within a radius of 5 NM from the centre of the R/Ws. Also, the KAVALA ALEXANDER THE GREAT CTR, covers the Airspace up to 8000 ft from the ground and within a radius of 12 NM from the centre of the R/Ws.

In order to enter the above controlled Airspace (Class D), an Aircraft must contact and obtain a permit from the Airport ATC. Thus, the ATC at all times knows the Aircrafts that are within its controlled Airspace. The ATC thus ensures the safe traffic of the Aircrafts by giving a separation in flight IFR to IFR and at the same time updating the VFR flights, as well as updating each Aircraft in VFR flight for all VFR / IFR flights.

On ‘VFR’ flights, it is the responsibility of the Pilots to avoid collisions with other Aircrafts and to maintain a safe height above obstacles.

1.11. Flight Recorders

The Aircraft was equipped with FDR and CVR in accordance with international regulations. The FDR and the TCAS computer were removed for the investigation. The CVR was not removed as data during the event had been erased by more recent ones.

1.12. Wreckage and Impact information

Not applicable.

1.13. Medical and Pathological Information

Not Applicable.

1.14. Fire

Not Applicable.

1.15. Survival Aspects

Not Applicable.

1.16. Tests and Research

Not applicable.

1.17. Organizational and Management Information

1.17.1 Condor airlines

Condor Flugdienst GmbH, is a German Airline based in the International Airport of Frankfurt and the owner is 'Thomas Cook Group Airlines'.

1.17.2 ASNF – Air Applications

ASNF – Air Applications' is a company based at Macedonia Thessaloniki Airport, which activities is Helicopter spraying in agriculture.

1.18. Additional Information

1.18.1 TCAS

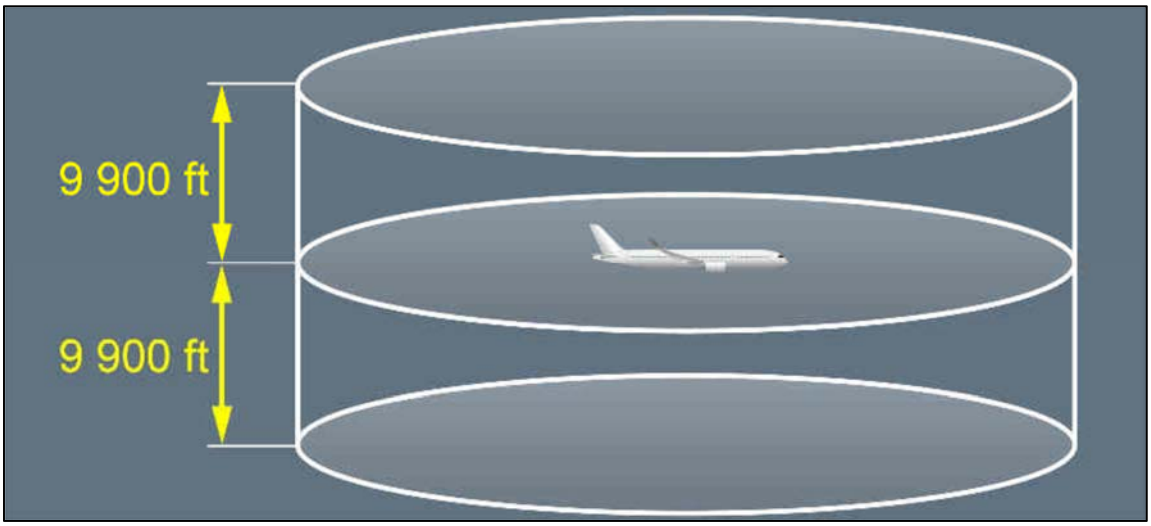
Overview

The Traffic alert and Collision Avoidance System (TCAS):

- Detects and displays surrounding aircraft that have a transponder
- Calculates and display possible collision threats
- Triggers vertical speed orders, in order to avoid collisions.

Principle

The TCAS detection capability is limited to intruders flying within a maximum range of 30 NM on either sides and approximately 30 NM to 80 NM longitudinally (depending on aircraft configuration and external conditions), and within a maximum altitude range of 9,900 ft above and below the aircraft.



TCAS Range

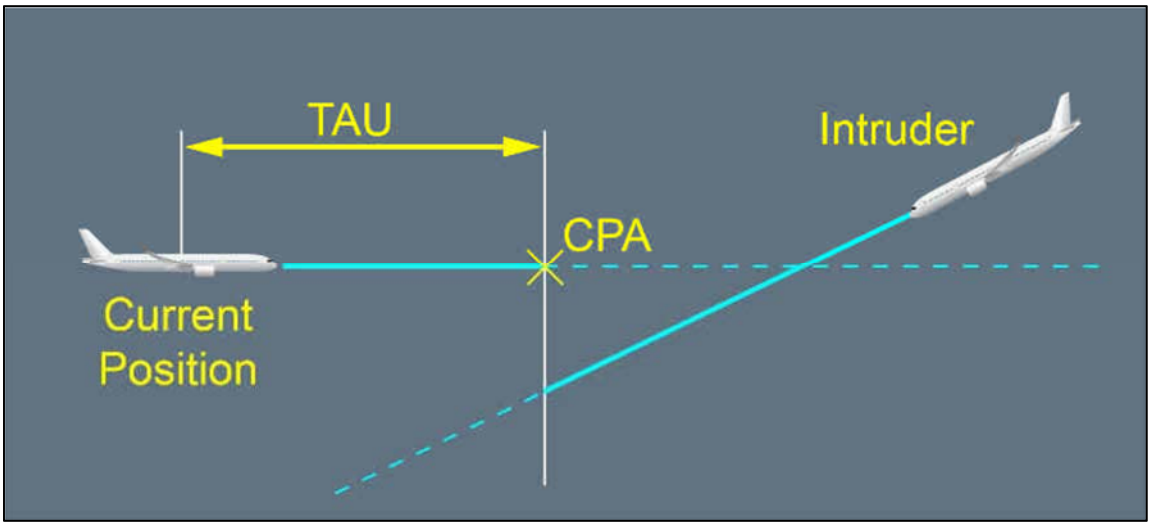
The TCAS obtains data transmitted by the transponders of nearby aircraft and uses this data to evaluate possible collision threats.

The TCAS determines:

- The bearing of intruders, in relation to the bearing of the aircraft.
- The distance between the aircraft and intruders, and the rate of separation or closure.
- The relative altitude of intruders, if intruders have a Mode-C or Mode-S transponder.

The TCAS then calculates the intruder trajectory, the Closest Point of Approach (CPA), and the estimated time (TAU) before reaching the CPA.

The TAU is the ratio between the distance that separates both aircraft, and the sum of their speed.



TAU Definition

If the TCAS detects that the trajectory of an intruder may be a collision threat, it triggers:

- Audio and visual indicators.
- Vertical speed orders, to ensure a sufficient trajectory separation and a minimal vertical speed variation considering all intruders.

Main Components

The system includes:

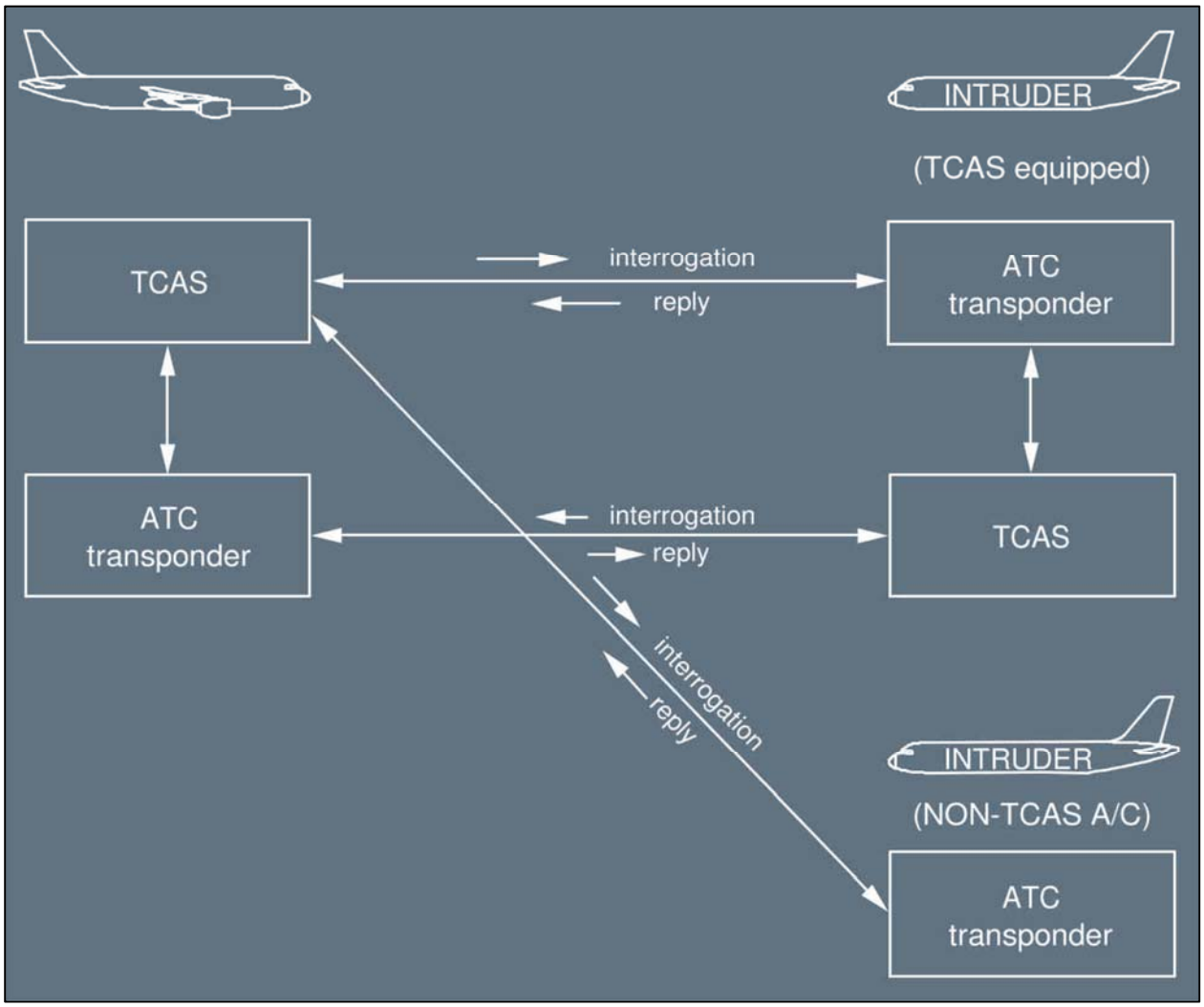
- A single channel TCAS computer
- Two TCAS antennas

- Two mode S ATC transponders, one active the other in standby.

These transponders allow:

- Interface between the ATC/TCAS control panel and the TCAS computer
- Communication between the aircraft and intruders equipped with a TCAS system.

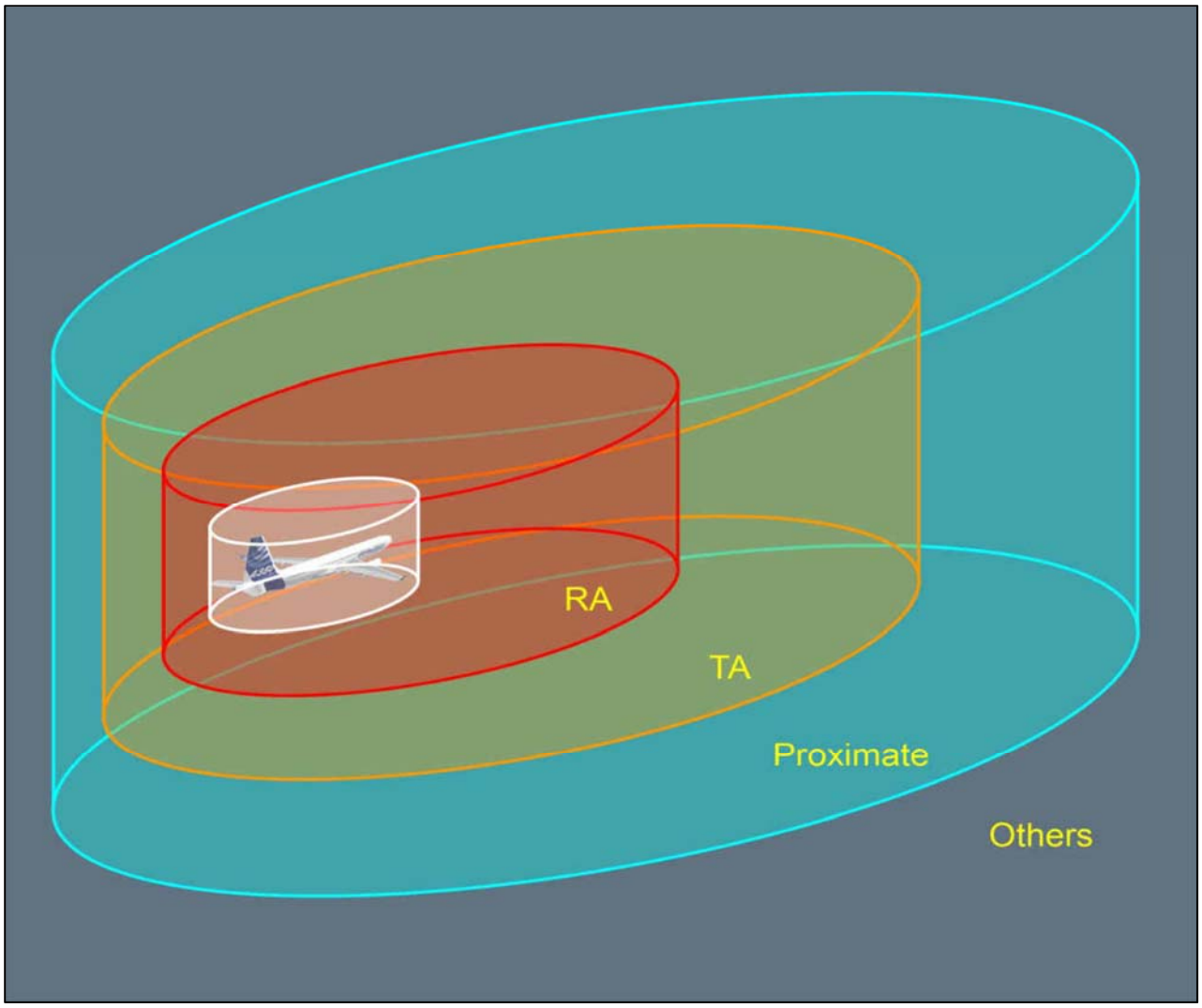
- An ATC/TCAS control panel.



Intruder Detection Categories

The TCAS divides the space surrounding the aircraft into the following four zones, in order to evaluate and categorize possible collision threats:

- Resolution Advisory (RA)
- Traffic Advisory (TA)
- Proximate intruders
- Other intruders.

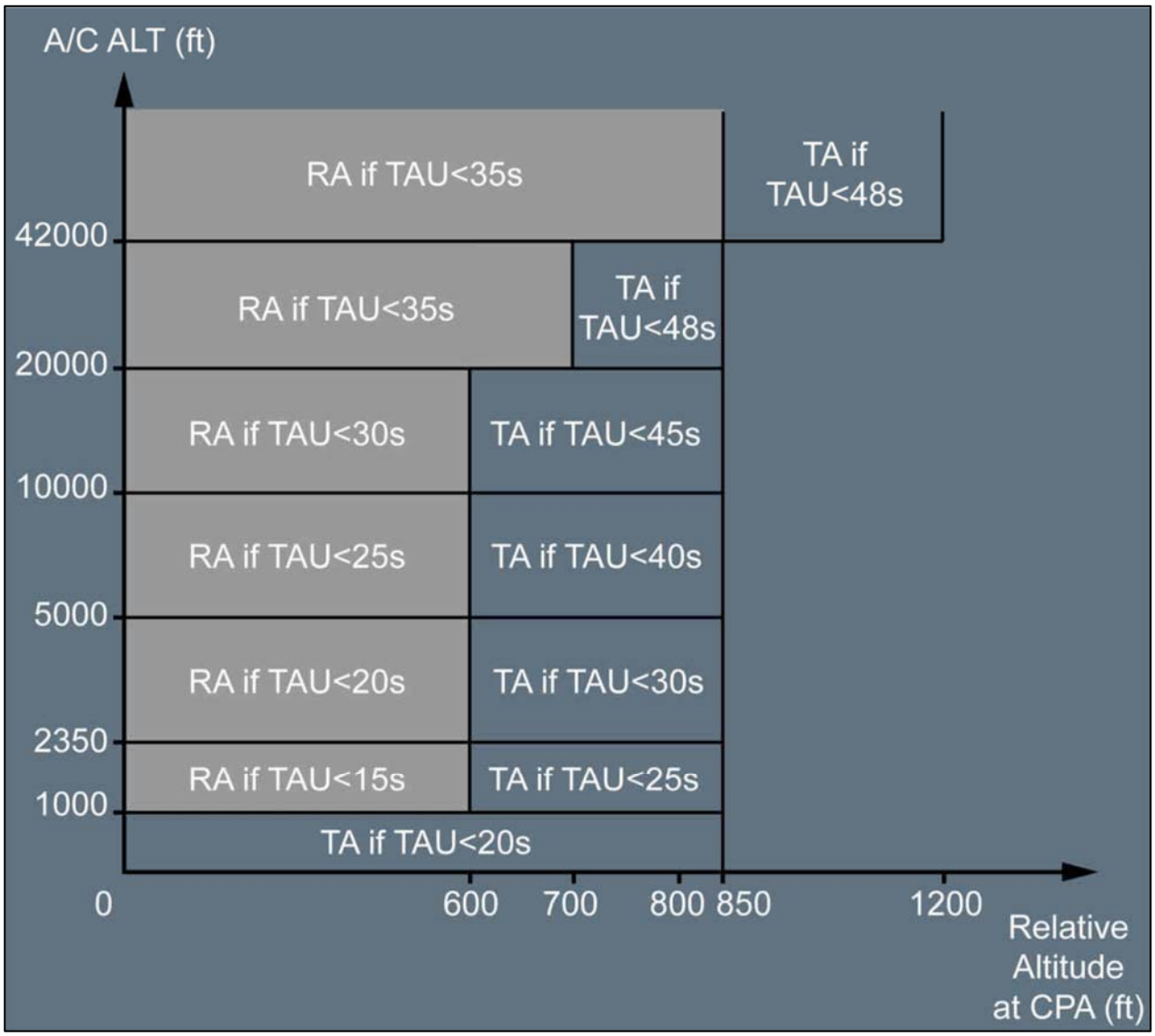


TCAS Envelopes

Depending on the level of the collision threat, the TCAS triggers audio and visual indicators:

LEVEL	INTRUDER POSITION	DISPLAYED INFORMATION AND MESSAGE	
Other intruders	- No collision threat - Any non-proximate, TA, RA within the surveillance envelope (lateral range: Closer than 30 NM)	ND: Intruder position	
Proximate	- No collision threat - Intruder in the vicinity of the A/C (closer than 6 NM laterally and ±1,200 ft vertically)	ND: Intruder position	
TA	Potential collision threat in about 40 s - TAU is about 40 s	- ND: Intruder position - Aural messages	

RA	Real collision threat in about 25 s - TAU is about 25 s	- ND: Intruder position - Aural messages • Maintain actual V/S or • Modify V/S	



TA/RA thresholds

TCAS MODES

The TCAS has three different modes of operations that can be selected on the ATC / TCAS control panel:

- The Traffic Advisory/Resolution Advisory (TA/RA) mode
- The Traffic Advisory Only (TA ONLY) mode
- The standby (STBY) mode.

TA/RA Modes

The TA/RA mode is the normal TCAS operating mode that enables:

- The ND to display all intruders
- The PFD to display the vertical speed orders that indicate the vertical direction that the aircraft should take, in order to avoid a collision.

TA Only Mode
The TA ONLY mode can be selected:

- Manually in case of aircraft degraded performance (engine failure, landing gear extended), or in specific airports, and for specific procedures (identified by operators) that may provide RA that are neither wanted nor appropriate (e.g. closely-spaced parallel or converging runways).
- Automatically, if TA/RA mode is previously selected and:
- The windshear alert is triggered
- The stall warning is triggered
- GPWS alerts are triggered
- Aircraft is below 1 000 ft AGL.

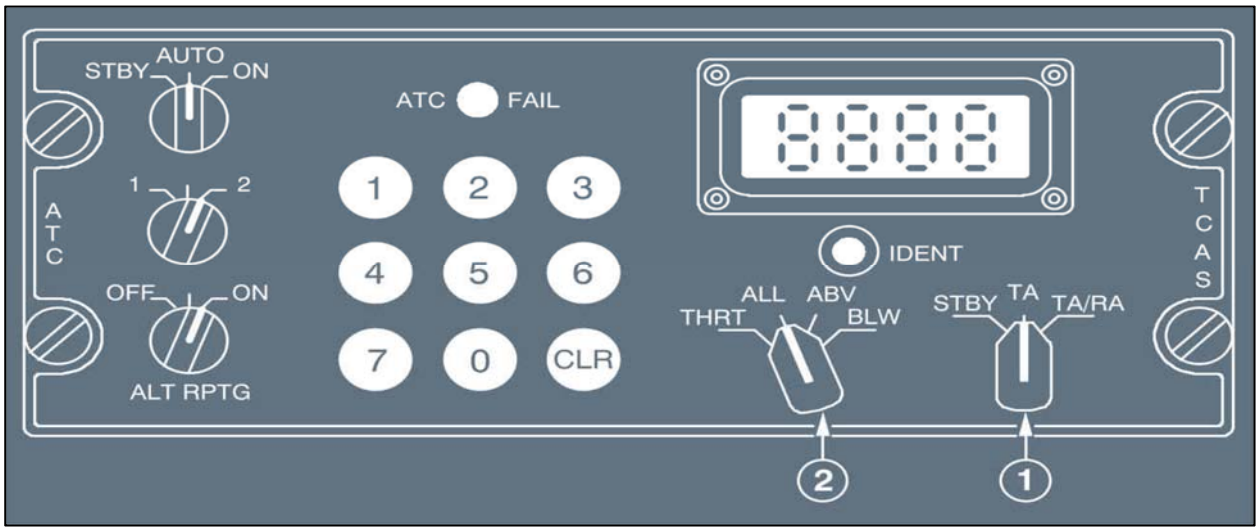
When the TCAS is operating in TA ONLY mode:

- All RAs are inhibited and converted into TAs
- TA threshold is set to TAU ≤20 s, irrespective of the aircraft altitude
- No vertical speed advisories are indicated on the PFDs
- "TA ONLY" is displayed on the NDs.

Standby Mode
In the standby mode, the advisory generation and surveillance functions are not active. The TCAS does not trigger any alert. No TCAS information can be displayed on the PFDs and NDs.

Advisory Inhibition
Some advisories are inhibited depending on the aircraft altitude:

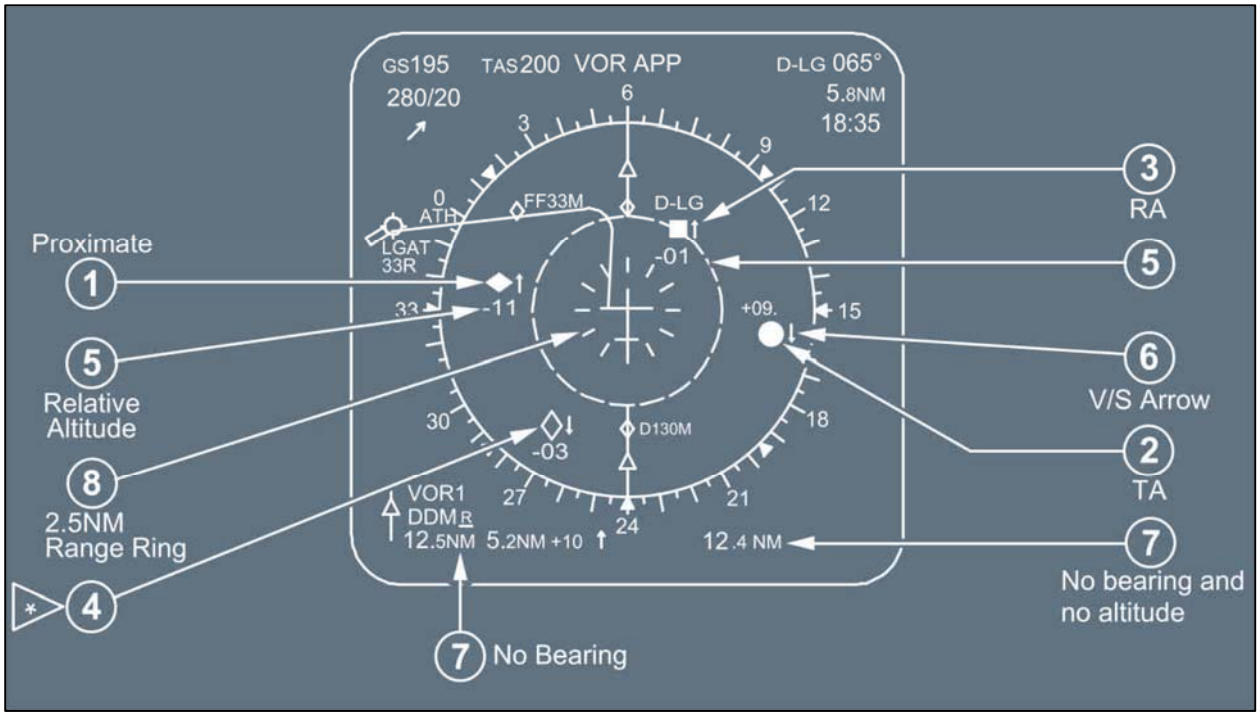
- All intruders flying below 380 ft AGL when the own aircraft altitude is below 1,700 ft AGL
- All RA below 1,100 ft in climb and 900 ft in descent. In this case, the RAs are converted into TAs
- "Descend" RA below 1,100 ft AGL
- "Increase Descent" RA below 1,550 ft AGL
- All TA aural messages below 600 ft AGL in climb and below 400 ft AGL in descent
- The AP/FD TCAS flight guidance mode is inhibited below 900 ft.



(1) **Mode selector**
TA/RA: Normal position.
The RAs, TAs and proximate intruders are displayed if the ALT RPTG switch is ON and the transponder is not on STBY.
TA: The TCAS does not generate any vertical orders. This mode should be used, in case of degraded aircraft performance (engine failure, landing gear extended, or approach on parallel

runways). All RAs are converted into TAs. TAs, proximate and intruders are displayed if the ALT RPTG switch is ON and the transponder is not on STBY. The "TA ONLY" white memo is displayed on the NDs.
STBY: The TCAS is on standby.
(2) **Traffic selector**
THRT: Proximate and other intruders are displayed only if a TA or RA is present, and they are within 2 700 ft above and 2 700 ft below the aircraft.
ALL: Proximate and other intruders are displayed even if no TA or RA is present (full time function). The altitude range is -2,700 ft to +2,700 ft.
ABV: The same as ALL, except that the other intruders are displayed if within 9,900 ft above the aircraft and 2,700 ft below.

The traffic is displayed in all ROSE modes and ARC mode when 10, 20 or 40 NM range is selected.
Only the 8 most threatening intruders are displayed.



1) Proximate intruder
   Indicated by a white filled diamond.
2) TA intruder
   Indicated by an amber circle.
   Associated with the TRAFFIC-TRAFFIC aural message.
3) RA intruder
   Indicated by a red square.
   Associated with vertical orders displayed on the PFD and aural messages.
4) Other intruders
   Indicated by a white empty diamond.

Note: If the range of an intruder is not available, the intruder is not displayed. An intruder may be partially displayed when its range is out of scale.

5) Relative altitude
   Indicated in hundreds of feet above or below the symbol depending on the intruder position.

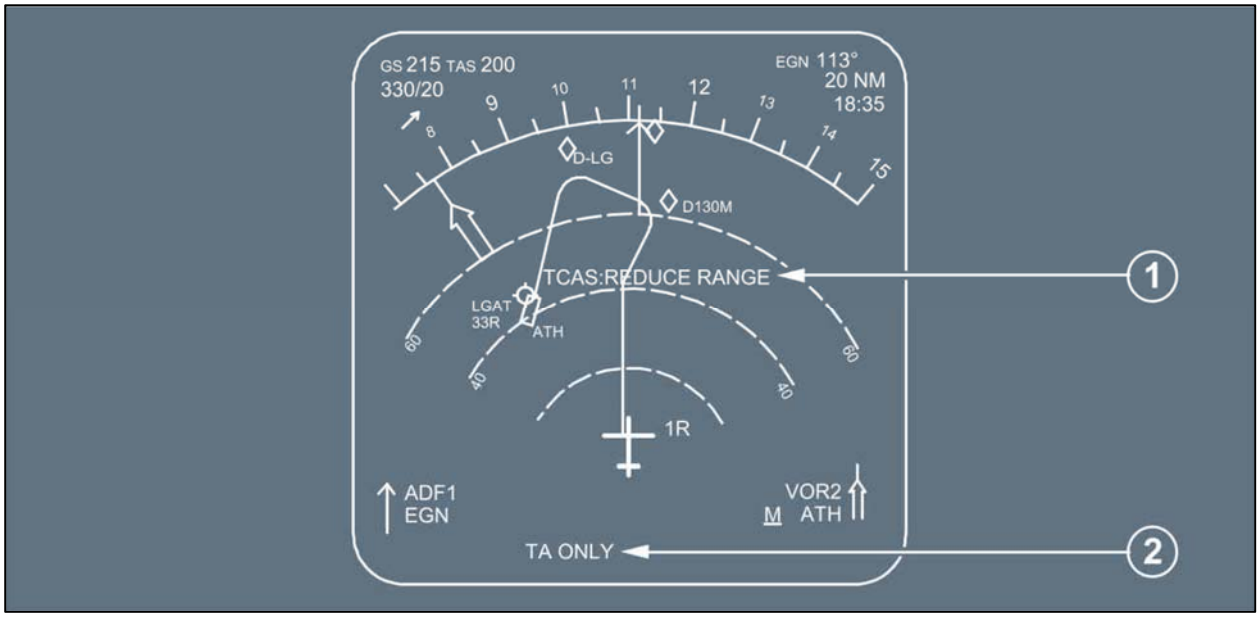
6) Vertical speed arrow
Displayed only if the intruder V/S > 500 ft/min.
Relative altitude and vertical speed arrow are displayed in the same colour as the associated intruder symbol.

Note: If the altitude of an intruder is not available, neither altitude nor vertical speed indications are displayed.

7) No bearing intruder
If the bearing of TA or RA intruder is not available, the following data is presented in digital form at the bottom of the ND:
- Range
- relative altitude and vertical speed arrow if available.

Displayed amber or red according to threat level.

8) Range ring
A 2.5 NM white range ring is displayed when a 10 NM or 20 NM range is selected.



1) Mode and range messages
Following messages can be displayed to draw pilot's attention:

TCAS: REDUCE RANGE: Displayed when a TA or RA is detected and ND range above 40 NM.

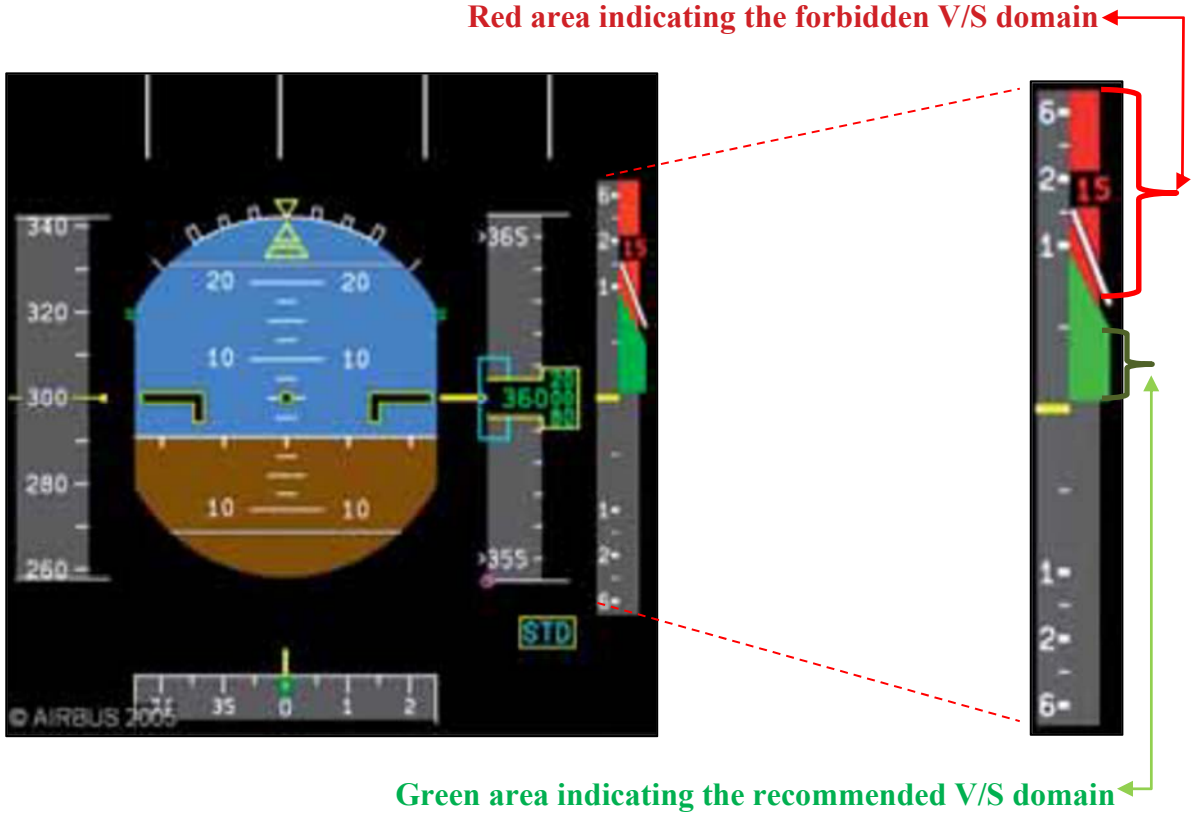
TCAS: CHANGE MODE: Displayed when a TA or RA is detected, and ND mode is PLAN.

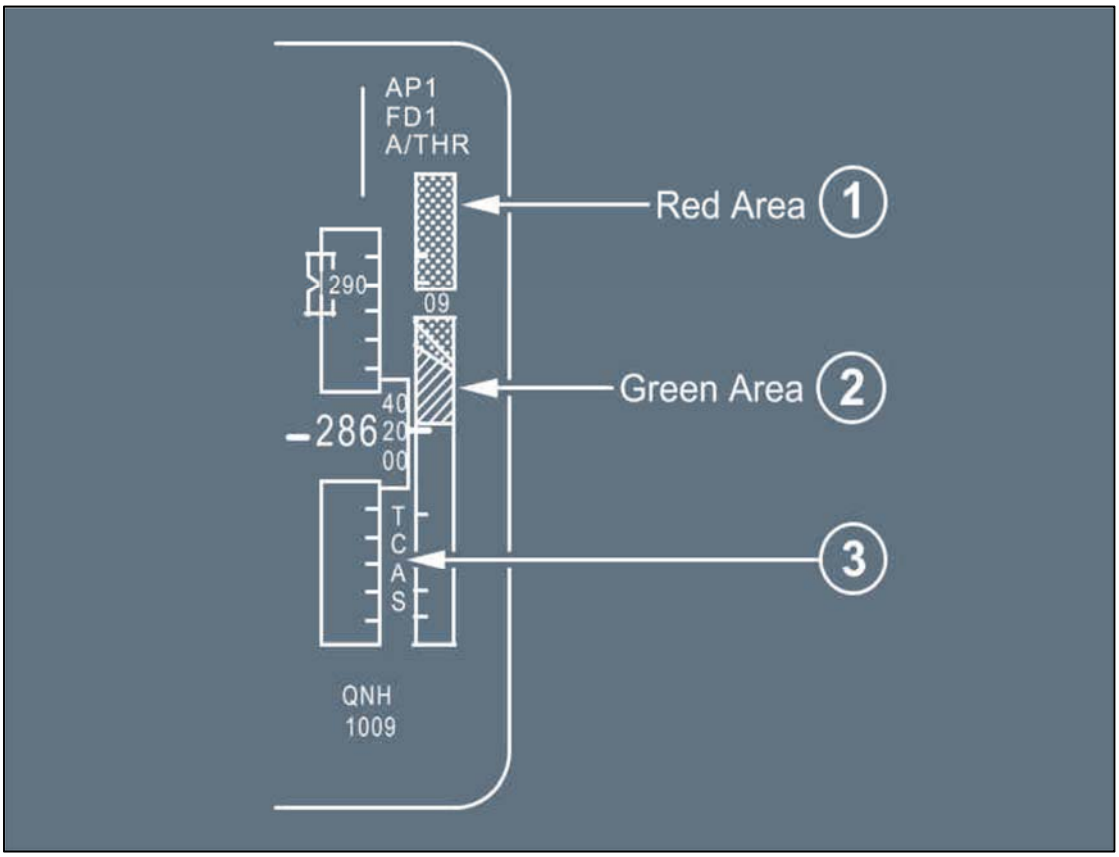
Displayed amber or red depending on the advisory level (TA or RA).

2) TCAS operation messages
TCAS: Displayed in case of TCAS internal failure.
TA ONLY: Displayed white when the TA mode is selected automatically, or manually by the flight crew.

PFD Indications

In case of RA detection, the PFD presents vertical orders on the vertical speed scale. The vertical speed scale background is normally grey but may be partially replaced by green and/or red areas.





1) Red area
   Indicates the vertical speed range, when there is a high risk of conflict.
2) Green area
   Indicates the recommended vertical speed range. It is wider than the red area.

Note: - The aircraft can also fly in the grey vertical speed range, without the risk of conflict (preventive RA).

- *The colour of the digits corresponds to the appropriate area.*
- *In case of RA detection, the vertical speed needle that is normally green, becomes white.*

3) TCAS message
   It is displayed when the TCAS cannot deliver RA data, or in case of an internal TCAS failure, provided that the TCAS is not in standby.

Aural Messages

TA/RA detection is associated with the following messages:

"TRAFFIC-TRAFFIC"	:	Only in case of TA detection.
"CLIMB-CLIMB"	:	Climb at the vertical speed indicated by the green area on the PFD.
"CLIMB-CLIMB"	:	Same as above. Indicates that you will cross through the intruder altitude.
"INCREASE CLIMB" (twice)	:	Triggered after the CLIMB message, if vertical speed is insufficient to achieve safe vertical separation.
"DESCEND-DESCEND"	:	Descend at the vertical speed indicated by the green area on the PFD.
"DESCEND, CROSSING DESCEND" (twice)	:	Same as above. Indicates that you will cross through the intruder altitude.
"INCREASE DESCEND" (twice)	:	Triggered after the DESCEND message, if the vertical speed is insufficient to achieve safe vertical separation.
"LEVEL OFF, LEVEL OFF"	:	Set the vertical speed to zero.
"CLIMB-CLIMB NOW" (twice)	:	Triggered after the DESCEND message, if the intruder trajectory has changed.
"DESCEND-DESCEND NOW" (twice)	:	Triggered after the CLIMB message, if the intruder trajectory has changed.
"MONITOR VERTICAL SPEED"	:	Ensure that the vertical speed remains outside the red area. Triggered only once, in case of preventive RA.
"MAINTAIN VERTICAL SPEED, MAINTAIN"	:	Maintain the vertical speed indicated on the green area of the PFD.
"MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN"	:	Maintain the vertical speed indicated on the green area of the PFD. Indicates that you will cross through the intruder altitude.
"CLEAR OF CONFLICT"	:	The range increases and separation is adequate. Return to assigned clearance.

Memo Display

TCAS STBY: This memo appears in green when:
-ATC STBY is selected by the crew, or
-TCAS STBY is selected by the crew during flight phases other than 6, or
-ALT RPTG sw is OFF, or

-both ATCs or both RAs are failed.

TCAS STBY: This memo appears in amber when the flight crew sets the TCAS on STBY in flight phase.

1.18.2 Sidestick Priority Logic

Airbus' OTT literature focuses on 'hand over or take over' techniques of Aircraft control to enhance the efficiency and safety of operations. In the Aircraft, from its design, it is foreseen that each Pilot individually can intervene on his sidestick. If the two Pilots intervene simultaneously in their sidesticks, then the two actions are added numerically. In such a case we have a more dynamic response of the Aircraft than that expected by ´PF´ although it has been predicted that the sum of the two commands cannot be greater than the ´full deflection´ of one sidestick. Also, the response of the Aircraft may be lower than expected in the event that one operator commands in the opposite direction than the other. For this reason, both operators should not operate on the sidestick at the same time, an action called 'dual input' for which audible and visual alerts are provided. The Aircraft must always be operated by one Pilot and in cases a Pilot wants to take over or transfer control of the Aircraft, then he must follow the following procedures:

- **Handover of control**: In that case the PF states ''YOU HAVE CONTROL'' in order to hand over control of the A/C to the PM. There after the PM states, ''I HAVE CONTROL'' and there after the PM becomes PF and PF becomes PM.
- **Takeover of control:** There are usually two cases where ´PM´ takes over control of the Aircraft.
  1. The first is in the case of PF´s physical inability to control the Aircraft and
  2. the second in the event that ´PF´ flies the Aircraft out of the planned route according to the flight plan and endangers the flight. In the second case it is done after an oral intervention to challenge the actions of the ´PF´ or immediately when there is no time for oral intervention.

In the case of 'Takeover of control', ´PM´ must clearly state ''I HAVE CONTROL'' and becomes PF after his declaration. He then immediately presses and holds the Sidestick red pushbutton until the other Crew member reacts by saying ''YOU HAVE CONTROL' 'and removes his hand from his sidestick.

If both Pilots push their own Sidestick red pushbutton at the same time, the last Pilot to push it has priority. One Pilot can also deactivate the other Pilot's sidestick by pressing his own sidestick red pushbutton for an extended period of time.

Crew Member priority on the sidestick

If a Crew member wants to have priority, he must press the priority red pushbutton on his sidestick:

- An automatic aural ‘’PRIORITY LEFT’’ or (RIGHT) sounds informing both Pilots who has priority and control of the Aircraft.
- A red arrow shows the direction of the Pilot having priority.
- The CAPT or F/O indication having priority becomes green.

Fig. 16: The left-hand seat has priority. Usually the Captain. The right-hand seat arrow lights red.

Fig.16 displays the indications when the left-hand seat Pilot (**CAPT**) intervenes on his sidestick by pressing the red pushbutton on his sidestick and that Pilot has priority. The red arrow indication and green indication disappear when the righthand seat Pilot remove his hand from his sidestick.

Fig. 17: The left-hand seat has priority. Usually the **Capt**

Fig.17 displays the indications when the right-hand seat Pilot intervenes on his sidestick by pressing the red pushbutton on his sidestick and that Pilot has priority. The red arrow indication and green indication disappear when the left-hand seat Pilot remove his hand from his sidestick.

Fig. 18: The right-hand seat has priority. Usually the **F/O**.

Fig. 18 indicates dual side stick input. Both Pilots are moving their sidesticks without anyone having priority. Aural sound “DUAL INPUT” is heard.

Fig. 19: both Pilots are moving their sidestick without anyone having priority with the activation of the aural sound “DUAL INPUT”

1.19. Useful or Effective Investigation Techniques

Not applicable.

2 ANALYSIS

2.1 The *intruder* in the TCAS control area of D-AICD Aircraft

This Analysis is based on QAR data, Crew interviews, ATC transcript and TCAS Computer

According to the transcript of the conversations of Kavala ATC, at 06:57:59 h we have the first communication of the Helicopter registration SX-HDW with Kavala ATC and at 06:58:13 h he announces that it took off from Xanthi destination Pontolivado, Kavala, Asprovalta, Panorama, with final destination Halastra Thessaloniki, climbing to 2,500 ft.

Taking into account the conversations of Kavala ATC with the Helicopter in the control area of the Airport, the course of the D-AICD Aircraft, the course of the SX-HDW Helicopter, the fact that the flight altitude stated and according to its flight plan was 2,500 ft, but also the time of the TCAS INCIDENT, it appears that the Helicopter was the only Aircraft that could be in the D-AICD TCAS control area during the flight that triggered a ‘’TCAS TA / RA ‘’.

Also, as mentioned above, as the interview of the Helicopter Pilot was not possible, the Helicopter passenger statement seeing a large Aircraft flying under the Helicopter at a low altitude, movements similar to those of the D-AICD Aircraft after its take-off. The Helicopter according to the TCAS data of the Aircraft remained at a fixed altitude of 2,896 ft throughout the TCAS INCIDENT, instead of 2,500 ft as expected according to its flight plan.

2.2 Visual departure / Kavala Airport Airspace.

The ‘KAVALA MEGAS ALEXANDROS CTR’ class D, covers the Airspace up to 8,000 ft MSL and within a 12.2 NM radius from KVL VOR.

In the above CTR, any Aircraft in order to enter must request and declare its position, altitude and its intention in order to be allowed to enter the CTR (Class D) of the Airport. As such, the ATC knows at any time all Aircrafts flying in the controlled area of the Airport. The ATC then ensures safe traffic movement giving instruction to Aircrafts for safe separation to all IFR movements and at the same time decide whether to allow a VFR departure or any other VFR movement within its CTR.

All VFR allowed traffic are responsible of separation with other informed traffic as well as to avoid high terrain and obstacles within the CTR.

After the request of the D-AICD Flight Crew at 06:50:51h for a VFR departure, that was granted and take off clearance was given from RW 23L at 07:00:14 h.

The D-AICD Flight Crew was not informed of the presence, position, altitude and course of the Helicopter in the Kavala CTR in order to raise its attention and awareness. Furthermore, all communications between the Helicopter and ATC was in the Greek Language, not understandable by the D-AICD Flight Crew.

2.3 TCAS of D-AICD Aircraft

On departure From Kavala Airport to Munich Airport CM 2 was PF and CM 1 PM.

At 07:09:49 h, and at an altitude of 2,650 ft, an aural warning was triggered ’TRAFFIC-TRAFFIC’’ from TCAS. Two sec later at 07:09:51h and at an attitude of 2,700 ft the TCAS followed by TCAS RA ‘‘MAINTAIN V/S’’. At the time of the warning, the V/S was +1,600 ft/min, according to the required by TCAS V/S and within the green V/S band. The first 3 sec after the warning ‘’TRAFFIC-TRAFFIC’’ the (CM2) gave a ‘nose down command’, with a pitch down of the Aircraft at 3,2^{o} and thus, reducing the rate of climb from V/S +1,600 ft/min to +1,100 ft/min. At the TCAS RA ‘’MAINTAIN V/S’’ at the time vertical speed was outside the green V/S band 3,5 sec later, the PF started giving ‘nose up command’ to increase V/S, in order to regain the green V/S band but at that time according to the Aircraft inertia the V/S had reached +500 ft/min with a result of never reaching the green band and the TCAS reversed its command to ‘nose down command’and thus the (CM2) sidestick had an average deviation of -1.02 ° nose up command direction.

At 07:09:51 h and while D-AICD was going through an altitude of 2,700 ft, the TCAS reversed its command to ‘’DESCEND RA’’, ordering the Flight Crew to reach a descent rate of -1,500ft/min within 2,5 sec. The V/S at that incident time was +600 ft/min so the change of V/S to -1,500ft/min should have been a change over 2,100 ft /min from climb to descent rate and within 2,5 sec in order to reach the required V/S green band.

The PM (CM1), at the command of TCAS ‘’DESCEND RA’’, gave a nose down on the sidestick without following the SOP for take over control. The PF (CM2), having the feeling that the response of the Aircraft was not as expected, not having realized the intervention of the PM (CM 1) and having the feeling that the response of the Aircraft was not as expected to his actions, gave a nose up command on the sidestick, an action that did not correspond to the TCAS “DESCEND RA’’ (Reversal RA).

The simultaneous actions of both Pilots on the sidesticks, nose down the (CM1) and Nose up the (CM2) at an altitude of 2,763ft, the command of TCAS ‘’INCREASE DESCEND’’ RA’ was triggered as the descent rate was -600ft/min instead of the required to be -1,500ft/min. The

incoming Helicopter was at 2,869 ft and as the green required by TCAS V/S was not reached, the closest distance between them was recorded, with the vertical being 208 ft and the horizontal at 0.09 NM (167 m).

The dual sidestick inputs of the Pilots had a result of downward Aircraft pitch of $17,9^0$ that gave a high negative G-Load that made the (CM2) to act on the sidestick giving a nose up command in contrary with the required at the time by the TCAS command.

At 07:10:12 h and at altitude of 2,414 ft, a caution warning was activated sounding “TERRAIN AHEAD”. The (CM1), according to the testimony, ordered ‘’I HAVE CONTROL’’ and executed a climb at a pitch attitude greater than 11^0 with TOGA thrust achieving a climb rate of 3,000 ft/min.

The (CM1) does not recall having pressed the Takeover Pushbutton. Nevertheless, 7 sec after the GPWS warning, there are no recordings for the (CM2) interventions on the sidestick maybe to (CM1) having pressed the takeover push button or no movement on the right hand (CM2) sidestick after the (CM1) commanded ‘’I HAVE CONTROL’’.

From the time 07:10:20 h, there are no more records of (CM2) movements on the sidestick and this was the first time that the meaning of ΄PF΄ becomes clear after the first 'dual input condition' on 07:09:55 h (25 sec duration of dual inputs).

From the above it appears that (CM2) which was PF did not comply for sometimes with actions required on the sidestick in order to follow the TCAS commands requirements.
Also, as (CM1) was PM, there were interventions on the sidestick without following the SOP for “Takeover of control”, thus creating the feeling to the (CM2) that the response of the Aircraft was not as expected with its own actions on the sidestick, as a result of which giving commands to the sidestick not in accordance with those of TCAS requirements.

3. CONCLUSIONS

3.1. Findings

→ The weather conditions were not a contributing factor to the incident.

→ The Pilots Aircraft Licenses were valid as well as their Medical certificates met the requirements for the flight.

→ The Aircrafts were airworthy and had current all their legal documents.

→ There were no signs of a technical malfunction contributing to the incident.

→ The communications of the D-AICD Aircraft with Kavala ATC were conducted in English without any problems.

→ The communications, in Greek language, of the Helicopter with ATC and vice versa, were not understood by the Flight Crew of D-AICD Aircraft.

→ The Helicopter with registration SX-HDW was the *intruder* in the TCAS system area of D-AICD Aircraft**.**

→ The Pilot of the Helicopter did not comply with his flight plan for Flight at 2,500 ft. Most probably flying at a wrong QNH.

→ Actual QNH was not transmitted to the helicopter ZX-HDW by ATC on first contact with Kavala.

→ (CM2) being ΄PF΄ of D-AICD, for some time, did actions on the sidestick not according to SOP by applying nose down on the TCAS aural warning ‘’TRAFFIC-TRAFFIC’’.

→ (CM1) being ΄PM΄ of D-AICD, intervened on the sidestick without following the SOP for take over control. Thus, creating the feeling to the (CM2) ΄PF that the response of the Aircraft was not as expected after his own actions on the sidestick.

→ The Pilots of all Aircrafts involved in the incident were within flight duty time and rest limitations and regulations.

3.2. Root Cause

3.2.1 First Root Cause:

Before Departure of D-AICD

ATC Failure, when allowing VFR departure, to inform the D-AICD Flight Crew of the Helicopter flying West and close of Kavala Airport at 2,500ft.

3.2.2 Second Root Cause:

At TCAS TA/RA

Failure, of D-AICD PF, to apply SOP's for TCAS TA warning ''TRAFIC-TRAFIC'', to maintaining V/S and subsequently at the first TCAS RA command of "MAITAIN V/S".

3.2.3 Third Root Cause

During TCAS escalation

The PM's intervention on the Side Stick, without following the SOP process of gaining control of the aircraft and such, the escalation of that serious incident.

3.3. Contributing Factors

→ Non-use of standard English language between Kavala ATC and the Helicopter.

→ ATC of Kavala not informing D-AICD Flight Crew of the current position, altitude and course of traffic inside Kavala CTR.

→ The Helicopter, most probably, flying at a wrong QNH as not being informed of the actual QNH by Kavala ATC.

→ The use of ARC instead of ROSE mode on ND by PF & PM, disabled the early detection of the *intruder.*

4 SAFETY RECOMMENDATIONS

- *Kavala ATC should have informed D-AICD about the presence, position course and altitude, of the Helicopter in the area of responsibility of Kavala Airport. Furthermore, no information of actual QNH was transmitted to the Helicopter. English Language must at always be used in order for all traffic, in the area, to have situation awareness.*

2021/10:

HCAA to remind and assure that Kavala Air Traffic Controllers strictly follow Regulations, regarding Air Traffic Management, according to Local, ICAO and EASA regulations.

- *The investigation revealed that the Flight Crew of D-AICD should have acted according to the SOP at the initial TA ''TRAFIC-TRAFIC'' and subsequent RA "MAITAIN V/S" proposed manoeuvre by TCAS and during the TCAS escalation that resulted in the DUAL SIDE STICK INPUT.*
- *With the selection of ROSE mode before take-off, the intruder would have been displayed on ND during initial climb before the right turn.*

2021/11:

a. CONDOR FLUGDIENST GmbH to consider improving the efficiency of the Flight Crew members when performing Simulator training TCAS manoeuvres and to emphasize the importance of the SOP regarding 'Takeover of control' process.

b. Consider, when in VFR departures and a turn of more than 70^0 after take-off, PF and PM to select ROSE mode on the ND instead of ARC. As such, an early detection of other traffics will be achieved.

Nea Philadelphia, July 01 2021

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