FINAL INVESTIGATION REPORT ON ACCIDENT TO M/s. AR AIRWAYS CESSNA CITATION 550 CII AIRCRAFT VT-CLC AT SURAT AIRPORT ON 14 OCT. 2011.

1. Aircraft	Type	: Cessna 550
	Model	: Citation II
	Nationality	: INDIAN
	Registration	: VT-CLC
2. Name of the Owner/ Operator		: M/s. AR Airways Pvt., Limited, New Delhi.
3. Pilot – in – Command		
	License No.	: ALTP Holder
	Extent of injuries	: Nil
4. Co – pilot		
	License No.	: CPL Holder
	Extent of injuries	: Nil
5. Passengers:-		
	No. of Persons on board	: 02
	Extent of injuries	: Nil
6. Place of accident		: Surat Airport, .
7. Date & Time of Accident		: 14/10/2011 at 123036UTC
8. Last point of departure & Coordinates		: Surat Airport, 21°06′57.76″N 072°44′30.55″E
9. Point of intended landing & Coordinates		: Surat Airport, 21°06′57.76″N 072°44′30.55″E
10. Nature of Operation		: Training Flight (Proficiency check)
11. Phase of Operation		: Landing
12. Type of Accident		: Runway Excursion
13. Aircraft Damage		: Substantial

(All timings in the report are in UTC unless or otherwise specified)

SYNOPSIS:-

M/s. AR Airways Cessna Citation 550 aircraft VT-CLC involved in an Accident while carrying out Proficiency check flight for the Co-pilot by DGCA, FOI at Surat Airport. At around 1230UTC, the Co-pilot carried out landing and the landing was normal but immediately after landing, the aircraft viciously started going to the right. The Pilot of the aircraft took over the controls and tried to prevent the aircraft from going to the right. However, he could not able to control the aircraft and the aircraft left the runway, went over the adjacent uneven grassy area and came to a complete stop by a rainwater drainage channel of approx. 6feet width and 4feet depth on its way.

The Accident was informed to DGCA, India and the investigation was carried out by an inspector of accident appointed by DGCA, India vide order No.AV.15013/9/2011-AS dated 17th Oct.2011, in accordance with the requirements of Rule 71 of Aircraft Rules 1937.

During investigation, it was found that main wheels stator disc found broken in to pieces. During the start of landing roll, RH main wheel got locked-up due to broken brake stator disc & resulted with drifting of the aircraft and Runway Excursion.

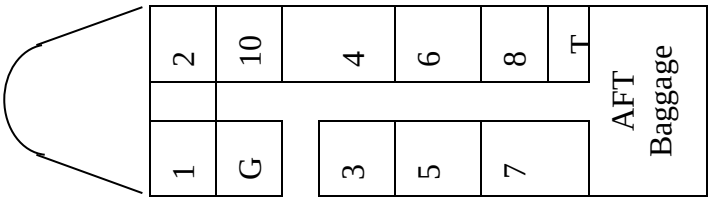
1. FACTUAL INFORMATION

1.1 *History of the flight.*

M/s. AR Airways Cessna Citation 550 aircraft Regn. VT-CLC on 14th Oct. 2011 was offered for planned training flights by the technician authorised under CAR 145 after he carried out necessary pre-flight inspection at Mumbai at 09:00UTC with 4400lbs of fuel onboard. The planned exercises/ checks were Route Check, IR followed by proficiency checks for Pilot and Co-pilot.

The aircraft got airborne from Mumbai airport at 1128UTC with DGCA, FOI onboard. Pilot carried out first landing at Surat at around 1205UTC. As per the plan, after landed at Surat airport, the Pilot was subjected for IR and proficiency checks. On completion, Pilot was asked to carry out go around and after the go around, controls were transferred to the Co-pilot for his Proficiency checks. At 1230UTC, Co-pilot carried out his first visual landing at Surat airfield on runway22. But immediately after landing, the aircraft viciously started going to the right. Pilot took over the controls and tried to prevent the aircraft from going to the right. However, Pilot could not able to control the aircraft and the aircraft left the runway and went to the uneven grassy area beside the Runway22-04 and came to a halt by the interference of rainwater drainage channel on the right hand side of the runway.

As per the company procedure, on 14th Oct. 2011, both the cockpit crew and a Cabin Attendant reported for pre-flight medical check-up around 0940UTC and on completion, flight crew reached the aircraft for preparation. Around 1000UTC, while crew carrying out pre-flight inspection, DGCA FOI reached the aircraft. The aircraft got airborne at 1128UTC from Mumbai with the 2 cockpit crew, 1 cabin attendant and a DGCA FOI. As there was no observer seat in the cockpit, FOI accommodated himself at seat No.10, which was behind Co-pilot seat facing rear cabin in front of forward galley and cabin attendant sat on a passenger seat No.5.



G- Galley
T- Toilet (seat No.9)

The Pilot (P1) was subjected for route check during Mumbai/ Surat sector and the aircraft landed at Surat airport at around 1205UTC. Immediately after landing, the aircraft informed Surat ATC that they would like to carry out 3 to 4 visual circuit exercises and then proceed to

Baroda. However, Surat ATCO had informed that the watch hour was up to 1200UTC and there was no approval for watch extension, the permission could not be granted and they were waiting for the departure of other scheduled flight and hence informed the aircraft to ready for their departure to Baroda. However, the aircraft requested the ATCO to accommodate them as they got delayed at Mumbai for more than one hour due traffic. After few seconds, the request was accepted and permission was granted to do circuit and landing exercises.

On acceptance of their request for training flights by Surat ATC, Pilot was subjected for IR check followed by another local circuit and landing. Thereafter, as directed by FOI, he carried out a single engine circuit and landing. On the next circuit, FOI instructed the Pilot to carry out a go around and on execution; controls were handed over to the Co-Pilot (P2) for his checks.

P2 carried out left hand circuit pattern for Rwy22. FOI initially wanted a Missed Approach for the Co-pilot. However, ATC denied the permission for missed approach and cleared the aircraft for a full stop landing due scheduled aircraft departure which was holding at the holding point on Rwy22. When they came on final, it was clear to the crew that it was going to be a normal full stop landing. On final approx. Vref+10 was maintained. (Vref. was 110Kts). The aircraft was stabilised during landing and the landing was normal and no bouncing was experienced. During landing engine parameters were idle and touchdown was carried out on the centreline within the touchdown zone. But immediately after landing, before application of manual braking, the aircraft started swinging to the right. Pilot immediately realised that and took over controls and tried to prevent the aircraft from going to the right by the application of full left rudder and full left brake and then moved the yoke fully to the left. Although the nose moved a little to the left, the aircraft kept skidding along the same path and the aircraft did not respond. He got feeling as if the right wheel got jammed. The aircraft left the Rwy22 at about 25-30° angle, went over grassy uneven ground and came to halt.

Pilot immediately switched off everything. On instruction from Pilot, after assessing the external condition, LH side cabin door was opened by Cabin Attendant and all rushed out and went away from the aircraft.

During the time of landing on Rwy 22, at around 1230UTC, ATCO observed that the aircraft swing off the Rwy22 and after crossing Twy 'A', it got stopped in kacha. ATCO pressed siren and crash bell and messaged on VHF also. Crash fire tender immediately reached the site and reported no fire or injury / casualty. At 1252UTC runway inspection was carried out and found fit accordingly the runway 22-04 was cleared for normal operation.

As per the eyewitness, the aircraft was carrying out normal landing on the centre of the Rwy22 and there was no bouncing of the aircraft nor did tyre burst take place.

1.2 ***Injuries to persons.***

Injuries	*Crew*	*Passengers*	*Others*
Fatal	*Nil*	*Nil*	*Nil*
Serious	*Nil*	*Nil*	*Nil*
Minor/ None	*Nil/02*	*Nil/02*	*Nil*

1.3 ***Damage to aircraft.***

The aircraft found with substantial damage.

Following major structural damages were observed;

(a) Starboard Main Landing Gear (STBD. MLG) Assembly & its Actuator got sheared off prior to the aircraft came to a complete halt.
(b) STBD. tyre & wheel hub found damaged.
(c) Mounting structure of MLG damaged and popped out from top skin.
(d) Metal and rubber boot leading edges also dented and wrinkled.
(e) STBD. Side Flap damaged.
(f) STBD. Aileron skin dented and wrinkled.
(g) Port MLG collapsed inboard due actuator ripped through top skin of wing and actuator is totally damaged.
(h) Port flap is damaged and skin is torn badly.
(i) Port side Aileron and wing tip damaged.
(j) Nose wheel Assembly and its mounting damaged and twisted.
(k) Hydraulic coupler and drain door was damaged.
(l) Nose section forward of the forward pressure bulkhead was significantly damaged. All three nose skins were crushed or buckled as were the internal supporting frames.
(m) Forward pressure bulkhead web was torn on the right side of the actuator feed through hole.
(n) Radome was damaged.
(o) Lower cockpit and aft cabin skins have been dented and gouged in several locations.
(p) Aft cabin skin PN 6511010-28 is dented from FS 320 to 345 (Aft Pressure Bulkhead) and from LBL 7 to RBL 7.
(q) Several lower cabin stringers were bent and buckled.
(r) A gusset on the trim tab pulley bracket support at FS 117 was found buckled.
(s) Lower tail cone was crushed from just aft of the aft pressure bulkhead to FS 400.
(t) Several wing to fuselage fairing panels were damaged from contact with the ground or were compressed with the movement of the wing.
(u) Stub wings sustained impact and buckling damage to several skins and frames.
(v) Exhaust for the vapour cycle air conditioning system was crushed.

(w) Right wing suffered significant damage to the rear spar when the right MLG separated from the aircraft. The wing also shows signs of twisting.
(x) Left wing has several skins with deep gouging from sliding on the ground
(y) Side brace fitting in the left wing was impacted when the inboard lug of the MLG actuator sheared.
(z) Both wing tips were damaged.
(aa) Hydraulic line support bracket on the main spar of the left wing is bent.

During insitu observation of cockpit switch position, antiskid system was found selected on.

1.4 ***Other damages:-***

Two Runway edge light installation and one Taxiway light installation got damaged.

1.5 ***Personnel information:***

1.5.1 Pilot:-

Indian
Male
63Yrs., 10/08/1948
Licence No. ALTP Holder valid upto 15/03/2012.
FRTO Licence valid upto 25/03/2013
Endorsement on Cessna Citation – II as PIC 04/07/1997
Other Endorsement: G200 as Co-pilot on 07/11/2006
English Language Proficiency valid upto 10/04/2017
RTR (A) valid upto 20/07/2030
Class one Medical done on 21/07/2011
Last Route check and PPC carried out on 24/05/2011.
Previous IR,RC & PPC carried out on 22nd Oct. 2010.

Flying Experience:
a. Total :- 9300Hrs.(approx.)
b. On Type :- 5200Hrs. (Approx.)
c. Exp. as PIC:- 4900Hrs. (On citation II)

Total flying experience:-
a. During last 90 Days : 35:05 Hrs.
b. During last 30 Days :19:05 Hrs.
c. During last 07 Days : 05:15Hrs.

d. During last 24 Hours: 00:50Hrs. (on 14th Oct. 2011)

1.5.2. Co-pilot:-

Indian
Male
45Yrs., 28/05/1966
Licence No. CPL Holder valid upto 31/10/2011.
FRTO Licence valid upto 09/04/2012
Endorsement on Cessna Citation – II as Co-pilot 12/07/2007
English Language Proficiency valid upto 08/04/2017
RTR (A) valid upto 25/03/2012
Class one Medical done on 26/09/2011 subjected to the limitations of wearing of corrective Bifocal glasses while exercising the privileges of his licence.
Last IR, Route Check and PPC carried out on 24/05/2011.

Flying Experience:
a. Total :- 1742Hrs.(approx.)
b. On Type :- 1350Hrs. (Approx.)

Total flying experience:-
a. During last 90 Days : 33:00 Hrs.
b. During last 30 Days : 19:05 Hrs.
c. During last 07 Days : 05:15 Hrs.
d. During last 24 Hours: 00:50 Hrs. (on 14th Oct.2011 accident flying)

As per crew flying records, both the pilots were provided adequate rest before undertaking the flight on 14th Oct. 2011 and there was no FDTL violation noticed.

1.6 ***Aircraft information:***

The aircraft was certified in accordance with FAR Part 25. Its primary flight control is accomplished through conventional cable- operated surfaces. Trimming is provided by aileron, elevator and rudder tabs. Hydraulically operated speed brakes are installed on the upper and lower surface of both wings. Trailing edge flaps are powered electrically. Nose wheel steering is mechanically controlled by the rudder pedals.

The Cessna Citation 550 aircraft, Serial Number 550-0698, was manufactured in 1992. First Certificate of Registration (CofR) was issued on 20/09/2006 by DGCA, India to AR Airways and at the time of accident, Certificate of Airworthiness (CofA) was valid up to 10/08/2012. Till the time of accident, the aircraft had carried out 3427 (including the accident landing) landings and flown 5342:27Hrs. Aircraft Max. All up weight authorised was 6395Kgs. and its Insurance valid till 29/08/2012. Last 5 yearly, aircraft weighment was carried out on 09/08/2011 at 5318:07Hrs.

Aircraft fitted with two P&W engines JT-15D-4. Engine S.No. PCE 71746 was found fitted on the Port Side & Engine S.No. PCE 71745 was on the Star board Side. Engines had logged 5341:27Hrs. of TSN and Cycles: 3423. Last Phase 3&4 inspection was carried out on 15/04/2011 at 5230:17Hrs and 3353cycles.

Till the time of accident, RH side and LH side tyres had carried out 73 & 98 landings (respectively) from the last tyre change carried out on 08/03/2011 (LH side) and 14/04/2011 (RH side).

1.6.1 Hydraulic system:-

Engine – driven pumps supply pressure for operation of the landing gear, speed brakes and thrust reverser through an open centre system. The main gear is equipped with wheel brakes actuated hydraulically from a separate, closed system. Pneumatic backup is available for landing gear extension and braking.

1.6.2 Aircraft wheel Brakes and Antiskid system:-

A. Wheel Brakes:-

Toe-actuated multiple disc brakes are installed on the main gear wheels. Braking can be accomplished by either power brake hydraulic system or the back-up pneumatic system. Normal braking can be applied from either cockpit seat. The emergency brake control is installed under the left instrument panel only.

B. Antiskid System:-

Antiskid/ power brake:-

The anti skid system provides power assisted braking with skid protection. It is designed to provide maximum braking efficiency of all runway surfaces.

System operation is conventional with power braking available at all speeds while antiskid protection is available a speeds above approx. 12Kts. The antiskid protection feature is designed to operate with maximum pilot brake applied pressure.

A switch on the instrument panel allows the pilot to select antiskid ON or OFF. When the switch is in the ON position, the antiskid function is operational. With the control switch in the OFF position, the ANTISKID INOP light on the annunciator panel will illuminate and the pilot will have power braking available without the anti skid function. If the power system should fail, braking will only be available through the back-up pneumatic system. The antiskid control module incorporates test circuitry which continually monitors the antiskid system. If a fault is detected, the ANTISKID INOP will be illuminated on the annunciator panel. If hydraulic pressure in the power system drops below 750PSI, the POWER BRAKE LOW PRESS light will illuminate.

The Antiskid was selected ON and remained ON throughout the training program. There was no antiskid inop light nor Brake low pressure light illuminated.

1.6.3 Aircraft maintenance history:-

On 06/05/2009, during phase 3 & 4 inspection, brake assembly part No. 2-1528-6 S/N 0690R on port side and P/N. 2-1528-6. S/N. 0381R on star board side was installed due wear pin indication. As per FAA form 8130-3 (Airworthiness approval Tag), both were overhauled by M/s. Goodrich Aircraft wheels and Brake, Wichita service centre, USA and both the assembly were released on 26th Jan 2009 after overhaul in accordance with CMM: 2-1528 ATA# 32-46-42 Revision:6 Rev. Date: 05/12/2006.

From the date of new brake assembly installation, the following tyre change activities took place.

Date	A/F Hrs.	Ldgs.	Details of work	Due
17/05/2009	4709:18	2973	RH main wheel assembly was replaced with serviceable assy.	cut found on tyre.
03/07/2009	4725:38	2983	LH main wheel replaced with serviceable assy. With new tyre.	tyre found worn out.
27/02/2010	4935:53	3163	RH main wheel assembly replaced with serviceable one with new tyre	tyre found worn out.
25/03/2010	4971:32	3189	Nose wheel assembly replaced	tyre worn out
05/04/2010	4991:37	3205	LH main wheel replaced with serviceable one.	tyre found worn out
10/09/2010	5082:37		RH main wheel assy. Replaced	as tyre worn out
08.03.2011	5175:42	3328	LH main wheel assembly replaced with serviceable one	for ops. Reason
14/04/2011	5230:17	3353	RH main wheel assembly with tyre replaced with new one	for ops. Reason.

1.6.4 Other remarkable activities:-

During the Phase 5 inspection which was carried out on 03/07/2009, along with LH main wheel replacement, antiskid system motor/ pump filler, Brake reservoir air filter, Brake reservoir supply line filter replaced.

On 15/07/2010, (A/F Hrs. 5039:25 and ldgs. 3245), Anti skid inop light came on once and brake became sluggish during Chandigarh/ Delhi sector PDR 5521) and as rectification work, antiskid inop light was not ON. Physical check of antiskid components reveals no abnormality found. Anti skid brake system operational test carried out as per task 32-42-00 -710 found satisfactory. Antiskid light did not come even once. Brake working satisfactory. Operation of reverse thrust is hard. As rectification, after deploying T/R found T/R is hard to operate. T/R pivot point lubrication and T/R guide rods lubrication carried out as per task 78-31-00-640 and 78-31-00-641. After lubrication T/R smooth to operate. T/R operational test carried out as per 78-31-00-71. Found satisfactory.

On 20/10/2010, during inspection found shimmy damper was leaking from internal seal. During rectification work, shimmy damper from VT-CLB was installed.

On 02/09/2010, (A/F Hrs. 5077:22Hrs.) involved in an incident in Mumbai/ Korba Sector. Pilot reported, after landing on N18, started 180Deg. Turn. While taking the turn RH wheel went off the runway approx. 12inches into the grassy and wet shoulder. Shutdown the engine and observed the wheel has bogged down into the grassy land. The RH wheel pulled by making a ramp in front of the wheel. No damage was observed on the aircraft.

During rectification work, RH main wheel assembly removed , brake assembly cleaned found no signs of damage. Wheel assy. Installed back security of installation checked and found satisfactory. On 03/09/2010, A/F Hrs. 5077:22Hrs. RH main wheel assembly removed and installed back after brake assy. Inspection.

1.6.5 Scheduled inspection details:-

With reference to scheduled inspections pertaining to wheels & brakes are Phase 1&2 and Phase 3&4. Pertaining to wheels and brakes, the following activities were carried out from the date of brakes assembly replacement;

No.	Date	A/F Hrs.	No of Ldgs.	Type of inspection
1.	06.05.2009	4697:08	2965	Phase 3&4 insp. (Brakes assembly replacement)
2.	03.07.2009	4725:58	2983	Phase 5 insp. Carried out.
3.	19.11.2009	4835:43	3079	Phase 1&2
4.	18.03.2010	4968:53	3187	Phase 3&4 insp.
5.	27.12.2010	5095:12	3287	Phase 1&2 inspection carried out.
6.	15.04.2011	5230:17	3353	Phase 3&4 insp.,

However, there were no remarkable maintenance activities taken place for the last six months period.

During the maintenance schedules, with reference to the tyre & brake assembly, Landing gear the following area were checked for maintenance activity.

No.	Type of inspection	Under task card No.	Maintenance/ Inspection Tasks
1.	Phase 1&2 (Alternate 150Hrs.)	32-11-01-210	MLG inspect
		32-11-01-220	Main Gear strut – check extension.
		32-31-05-210	Main Gear uplock – inspect
		32-41-01-210	Main wheel, Tire& Bearings – inspect & service
		32-41-01-211	Main Landing Gear wheel, Brake wear inspect
		32-42-01-210	Main Landing Gear Brake – inspect.
2.	Phase 3&4 (Alternate 150Hrs.)	32-42-01-211	Main Landing Gear wheel, Brakes wear inspect
3.	Phase 5 (1200Hrs./36months)	32-01-00-710	Landing Gear Ops. Check

After the installation new brake assembly, the above inspections were carried out during phase1&2 inspections on 19.11.2009 at A/F Hrs. of 4835:43 and 3079 landings and on 27.12.2010 at A/F Hrs. of 5095:12 and landings 3287. At an interval of 114 & 208 landings respectively.

Prior to the release of the aircraft for training operation, the technician authorised under CAR 145 at Mumbai carried out pre-flight inspection and during his pre-flight inspection, checked the tyre pressure by using the onboard tyre pressure gauge and observed that NLG tyre and MLGL/ MLGR was holding pressure of 123PSI and 122PSI/120PSI respectively.

As per the AMM, tyre pressure limits are 120 to 130PSI for NLG tyre and 115 to 125PSI for MLG tyre. The onboard tyre pressure gauge used for checking the tyre pressure at Mumbai, found calibrated on 21/06/2011 by M/s. Vikram Aviation Pvt. Ltd., Haryana which is an approved organisation by DGCA.

There is no minimum brake cooling period specified by the manufacture for consecutive departures.

1.6.6 Operational Documents:-

As per the Pax. Manifest, there were 4 SOB (P1, P2, FOI and Cabin Crew) throughout the sorties.

As per the Load and Trim report prepared at Surat, Basic empty weight was 8828.8lbs and fuel was 3800lbs. There were 4 SOB of 704lbs. and 60lbs of cabin bag gages. Total Ramp weight was 13392.8lbs (Max. 14300lbs.) and takeoff weight was 13192.8lbs.(total Ramp weight – taxing fuel of 200lbs.). calculated Actual CG was 280.94inches. (Allowable CG Range 276.1 inches – 286.8inches.) As per manual, Max. Landing weight is 13500lbs.

As per Tech. log report the aircraft was released with NIL snag at Mumbai at 1030UTC with 4400lbs of fuel and the aircraft took off at 1128UTC from Mumbai.

JET A-1 type of fuel was used. Fuel and oil samples were collected from the accident aircraft and sent to DGCA Laboratory and found with in specification and found satisfactory.

1.7 ***Meteorological information:***

As per the Met report, at 1230UTC, Wind 340/04, Visibility 06Km, Tem 34, DP23, QNH 1007. The weather information was also passed by the Surat ATCO when landing clearance was given. The accident happened prior to sunset time.

1.8 ***Aids to navigation:-***

Navigational aids like VOR, ILS, NDB, wind sock at Surat Airport available and were serviceable.

1.9 ***Communication:-***

Two way communications was established and the aircraft was always under Surat ATC control.

1.10 ***Aerodrome information:-***

Surat Airport is being maintained by Airports Authority of India. There is a schedule operator operating in and out of this airport apart from NSOP / private operators. One Private Flying school is also based at Surat Airport. This airport comes under 4C category. Category 6 rescue and fire fighting facility is available. Surface of the rwy 22 is upto156M concrete and 2094M asphalt.

Surat Airport has got a Runway 22/04 of 2250mx45meters with night landing facility. Airport is equipped with ILS on Rwy22, VOR on 22 and 04. Runway last re-carpeting done on 2007and the last friction test carried out on 11/02/2011. Average Friction value found as 0.81.

ATC watch Hours 0800UTC to 1200UTC daily except Saturday.

As per the Rwy inspection Register, on 14/10/2011, between 0800-0810UTC rwy inspections was carried out and found normal. PAPI/APP rwy 04/22 working normal and later on, after the accident, between 1242-1252UTC, runway inspections were carried out in order to clear the LLR 9608 aircraft .

During runway inspection after the accident, no Foreign Object damage found.

1.11 ***Flight recorders:-***

The aircraft was fitted with serviceable CVR and DFDR unit. Data recorders were recovered from the aircraft and found that the units were intact with no damage.

1.11.1 Cockpit Voice Recorder:-

CVR Part No.2100-1020-02, S.No.000362574 found installed in the aircraft and the unit retrieved from the aircraft without any damage. The CVR data was downloaded and tape transcript was prepared and the followings were observed:-

From the CVR it has been observed that the recording was clear and conversations were audible.

During Mumbai to Surat sector, aircraft carried out landing on Rwy 22 with winds 340/04kts and after aircraft speed slowing on Rwy 22, the Pilot requested ATCO, Surat for local visual training sortie. However ATCO has informed that as watch has closed (up to 1200UTC) and aircraft to be ready for departure & the ATCO was waiting only for the departure of (Airindia) the scheduled aircraft. The commander of VT-CLC had requested ATCO's to accommodate them as they got delayed at Mumbai for one hour due traffic and DGCA FOI onboard for carryout the checks. After few seconds, permission was granted.

The aircraft carried out first takeoff for local flying exercise on Rwy04 for right down wind and landed on 04 wind 340/04-05kts. Again on Rwy 22, took off with 340/04kts for visual Missed Approach and asked the aircraft to report on left downwind on Rwy 22. Meanwhile start-up approval was granted by Surat ATC for Airindia aircraft (LLR 9608) and it was asked to hold short of Rwy22.

After the missed approach, VT-CLC, on final 22, requested for one more circuit. But, ATC informed negative, and clear the aircraft to land on Rwy 22 wind 340/04kts. as LLR was ready for departure and holding at hold point Rwy22.

During the Missed Approach (MA) by the Pilot, the aircraft came upto 200ft (auto call outs) and MA was carried out by Pilot. After that, FOI instructed the Co-Pilot (P2) to take over and he could start flying on visual. FOI instructed the crew to carryout circuit at 1500ft. Just above the 500ft auto callouts, FOI told the crew to tell ATC to carry out one MA and one more landing. Accordingly, aircraft requested Surat ATC for MA. However, ATC denied the permission and informed the aircraft to carry out full stop landing on rwy22. Just four second after to 400ft auto call, the aircraft was prepared for full stop landing. After 200ft auto call, P1 has told Co-pilot to get in centre and settle down. After 100ft auto call, P1 told the P2 to reduce little throttle and get down. After 50ft auto call, P1 said ok and asked him to stay in centre. After 9 seconds of the 20ft auto call, the aircraft landed and within 5seconds, FOI shouted to push the rudder. Immediately, there was a sound similar to crash. After 16seconds after that there was an auto call of pull up pull up and that was the last call recorded in the CVR.

It has been observed that no checklists calls in the way of challenge and response found available.

(All the instructions by FOI were picked up by the area mike.)

1.11.2 Flight Data Recorder:-

FDR part No. S603-1000-00, Sl.no.000293262 found installed in the aircraft and the unit retrieved from the aircraft without any damage. The FDR was capable of recording the following parameters:

1.Relative Time
2.Pressure Altitude
3.Indicated Airspeed
4.Magnetic Heading
5.Vertical Acceleration
6.Pitch Attitude
7.Roll Attitude
8.Flaps Position
9.Auto Pilot
10.Comm Transmission
11.Engine LH N1
12.Engine RH N1
13.Thrust Reverser LH
14.Thrust Reverser RH
15.Speed Brake
16 OAT

The data was downloaded and from the FDR & followings were observed;

1.11.2.1. Mumbai – Surat (By Pilot)

1. At 124:09:38 aircraft got airborne from Mumbai from Rwy 27.
2. Aircraft reached maximum altitude of 17090ft Pr. Altitude at 124:21:40 and at 124:26:07 started descent from FL170.
3. At 127:47:13 Auto pilot was disconnected at 400ft. At that time IAS was 130Kts and Heading 225Deg.
4. At 124:47:47 carried out landing on Rwy 22 at Surat. Landing G was 1.29.
5. At 124:47:51, Speed Brake was deployed and at 124:47:53, Thrust Rev.LH&RH got deployed and remained deployed till 124:48:08. At 124:48:19, speed Brake stowed back.

1.11.2.2. Surat – Surat (first local flight – by Pilot)

The aircraft taxied to the rwy04 end and lined-up for local flights.

1. At 124:50:38, aircraft lifted off on Rwy 04. IAS was 109Kts and Flap 18Deg.
2. At 124:51:45, reached max. Altitude of 1207ft & started descend at 124:52:00
3. At 124:53:51 acft. Carried out landing on Rwy 22 with flap 40Deg., engines rpm were 30%&33% and OAT was 36Deg C. Landing G value was 1.23 and landing speed was 98Kts.
4. At 124:53:53 TRLH & TRRH deployed and at 124:54:09, TRRH side stowed and at 124:54:10TRLH side stowed back.

1.11.2.3. Surat – Surat (second local flight – OEI – by Pilot)

1. At 124:56:27 aircraft took off on Rwy 04 at 100Kts and flap 21Deg.
2. At 124:56:43, at 290ft pressure altitude, OEI (One Engine Inoperative) condition was simulated. At that time IAS was 132Kts; LH N1 rpm was 69% & RH N1 rpm was 92%.
3. At 124:56:50, LH N1was 41% & RH N1 was 95% at 362ft pr.altitude & At 124:56:55 LH N1 was 33% & RH N1 was 95% at altitude 410ft.
4. At 124:59:53 acft. Reached max. Pressure Altitude of 1353ft at the time LH N1 33%& RHN1 rpm 90%
5. At 125:01:26 acft. Carried out touchdown with 101Kts & with 1.28G on Rwy 04. LH N1 was 31% RH N1 was 30% with flap 41Deg.
6. At 125:01:27 LHTR and RHTR deployed and At 125:01:41, LHTR stowed and at 125:01:42 RHTR stowed back.

1.11.2.4. Surat – Surat (3rd local Flying – by pilot)

1. At 125:03:16, aircraft got airborne from Rwy 22 at 102Kts with LH N1 95% & RHN1 95% and flap was 20Deg.
2. At 125:04:30, reached max. Altitude of 1183ft with flap 20Deg. LH & RH engines RPM were 86% &84% respectively.

3. At 125:06:45 aircraft initiated go-around at pressure altitude of 362ft. LH & RH engines RPM were 87%&83% & heading 22Deg.

(AT this stage controls were transferred to Co-Pilot)

1.11.2.5. Surat – Surat (Co-Pilot's 1st check flight sortie)

1. Aircraft reached max. Pr. Altitude 1961ft at 125:08:06 and at that time LHN1 & RHN1 Were 85% & 84%. Flap was 21Deg. & OAT 35Deg C.
2. At 125:13:21 acft. Carried out landing on Rwy 22 with 104kts and magnetic heading was 226Deg. & flap was 41Deg. with G value 1.42, LH ENGN1 was 31% & RH ENG N1 was 32%. OAT 35DegC. No speed brake found operated.
3. At 125:13:22, aircraft speed was 103kts., with TR LH&RH still in stowed condition, heading changed to 233Deg.
4. At 125:13:23, speed was 99kts, heading was 234Deg. TRLH&RH deployed.
5. At 125:13:26, speed was 85Kts, heading was 226Deg. And TRLH&RH found deployed.
6. At 125:13:27, speed was 82Kts, both reversers found stowed.
7. At 125:13:28, when speed was 79Kts, heading changed to 236Deg. with roll of 3Deg.on RH side.
8. At 125:13:29 speed 76kts, heading 234Deg., roll 7Deg. to the RH side and pitch1Deg was recorded.
9. At 125:13:30 speed 72Kts, G value was 1.85. Only LHTR deployed and remained deployed till 125:13:41 and RHTR remained stowed condition during the above period and max. Roll angle of 12Deg. to the RH side was found Recorded at this time.
10. After 125:13:30 there were higher g values like 1.63, 1.83, 1.72, 1.49, 1.78 found recorded.

(All timings are relative time)

As per the DFDR, during the P2 check, aircraft carried out the landing at 104Kts on Rwy 22 with G value of 1.42G and the engines were at idle (31%/32%) . Immediately after one second, when the speed was 99kts, both TRs (RH&LH) found deployed for 4seconds and stowed back at 82Kts. Within 2seconds, at speed of 76Kts with heading of 234Deg., 7Deg. Roll to RH side was experienced by the aircraft. Immediately in the next second, at 72Kts of forward speed, 1.85G was found recorded and only left side Thrust Reverser found deployed for eleven seconds and the roll recorded was 12Deg. to the RH side of the aircraft.

Initially, LH engineN1 was 8%more than the RH engineN1. However, approx. 20sec. prior to the touchdown, LH engine N1 was reduced to approx. 5% and at the time of touchdown both the engines were at idle.

The aircraft Mumbai – Surat leg was completed in 40minuts. After that 3 local flying sorties were carried out with in 20minutes and the third one ended with an accident.

Between departures there were brake cooling period of approximately 6minutes, 07&½ minutes and 12minutes respectively were noticed.

1.12 ***Wreckage and impact information:-***

From the Rwy markings, the followings have been observed;

Aircraft made touch down at the touchdown zone on the Rwy 22. Immediately after touchdown, RMLG intermittent tyre marks was found predominant at 4 places parallel to the rwy centre line before making continuous deviation markings from the Rwy22.

First segment of RMLG tyre mark found on the rwy for a length of 104ft parallel to the Rwy 22 centre line between the RWY lights 1/16 and 2/15 at a distance of 12.1ft from the centre line of Rwy22 on the RHside. After a gap of approx. 74ft, second tyre mark noticed between the lights 2/15 and 1/15 is for a stretch of 41 feet and 12.5 ft away from runway centre line edge. Again after a gap of approx.68ft, the third mark observed between lights 1/15 and 2/14 for a stretch of 39 ft and is 12.1 ft away from centre line. After a gap of approx. 36.5ft, fourth mark has been noted between lights 2/14 and 1/14 for a stretch of 37 ft and is 12 ft away from the runway centre line edge. After a gap of 31ft, continuous veering mark of RMLG rub marks noticed toward right side of rwy 22 centreline from the RWY light 1/14 which is approximately 352 meter till it entered the grassy area initially. After that the aircraft rolled out, crossed the Twy 'A' and entered in to the grassy Kacha land.

After crossing of Twy 'A', Landing gear actuator & RHMLG found detached and laying on the path of the aircraft. The aircraft came to a final halt, as this got trapped by the rainwater drainage channel of approx. 6ft width and turned more than 180 degree before it came to rest.

The accident occurred immediately after landing. The aircraft was intact. Only the Starboard side Main Landing Gear Assembly and Landing Gear Actuator got sheared off and were found lying away from the incident aircraft with partially damaged tyre on the wheel hub.(approx 250 from Stbd. wing tip). Actuator and MLG assembly were laying approx 20 feet apart from each other.

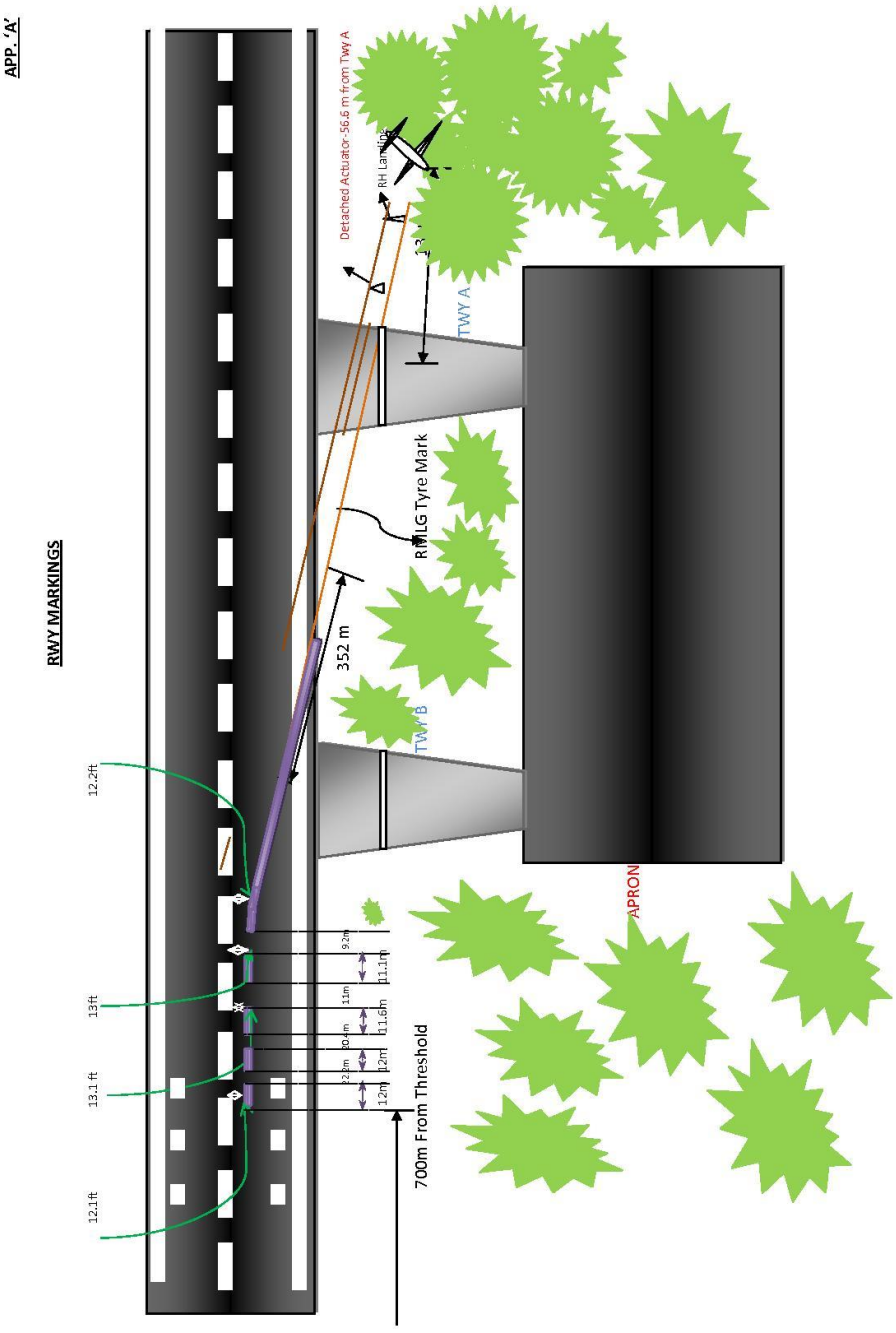

APP. 'A'
RWY MARKINGS
Detached Actuator- 56.6 m from Twy A
RH Landing
TWY A
RMLG Tyre Mark
352 m
TWY B
APRON
12.2ft
13ft
13.1 ft
12.1ft
700m From Threshold

Fig 1

Fig 2

Fig 3

Fig 4 (view from the other side of Rwy)

Fig 5 (view from the landing side)

1.13 ***Medical and pathological information:-***

The crew were subjected for Pre-flight Medical Examination at Mumbai using Alco Sensor-IV on 14/10/11 at 0940UTC (P1) and 0950UTC (P2) and they found fit by the qualified doctor and hence the crew were cleared to operate the flights on that day.

1.14 ***Fire:-***

There was slight smoke noticed after the aircraft came to a complete halt. Hence, Foam was used by Airport CFT to prevent any possibility of fire eruption. Necessary precaution and stand by arrangements were made by AAI, to prevent fire damage.

1.15 ***Survival aspects:-***

The accident was survivable.

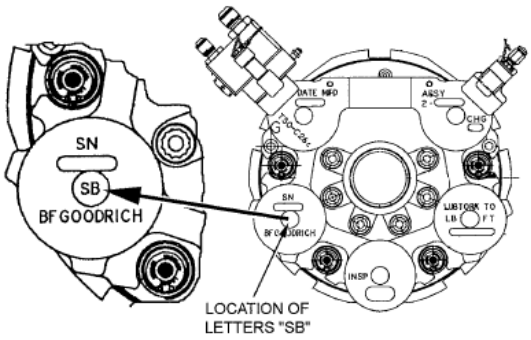
1.16 ***Tests and research:-***

The landing gear assembly and actuator was sent to DGCA, AED lab, New Delhi for failure analysis and the analysis was carried out on the detached actuator and found that the actuator had failed due to compressive over load.

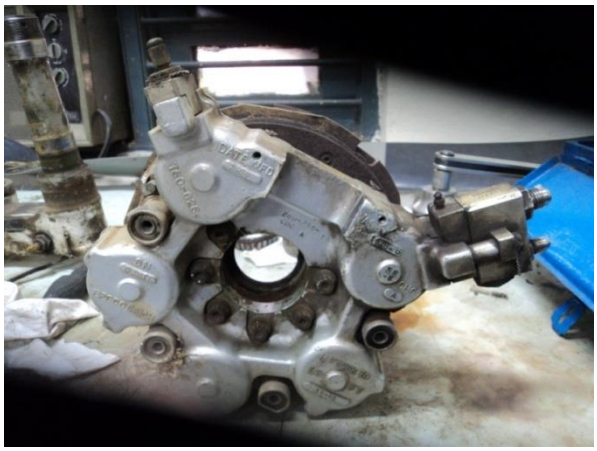
Later on the RH side of Main Landing gear tyre and brake assembly inspection was carried out at AED lab in the presence of operator and the DGCA team. The followings are the observations;

As per the GOODRICH SERVICE BULLETIN 2-1528-32-2 on "Landing Gear – Brake Assembly – Possible Cracked Stator Disks" issued on 19th Feb.2003, if the brake assembly was overhauled by Goodrich after March 2000, this service Bulletin was completed and the latest Stator disks are installed. The Brake assembly was overhauled by M/s. Goodrich in 2009. However, during inspection, on brake assembly, the compliance of SB could not be identified.

Brake Stators and rotors were found rotating and no sign of overheating observed.



BA – 1



BA-2

BA-3

BA-4

BA-5

BA-6

BA-7

BA-8

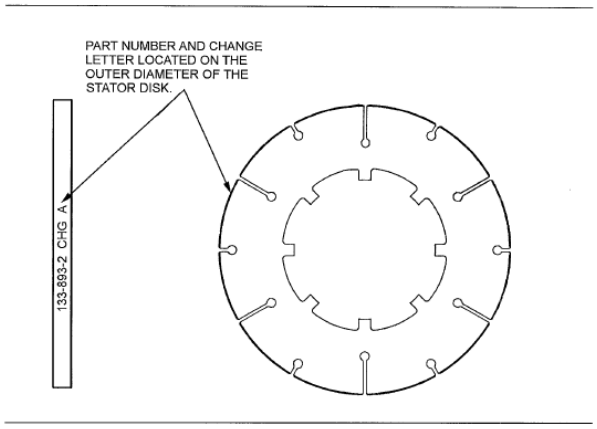
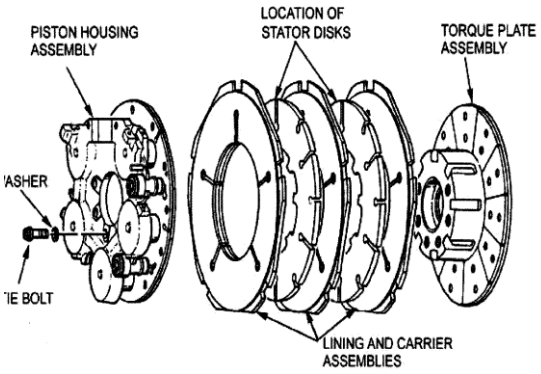


Figure 1. Identification of Stator Disks

BA-9



BA-10

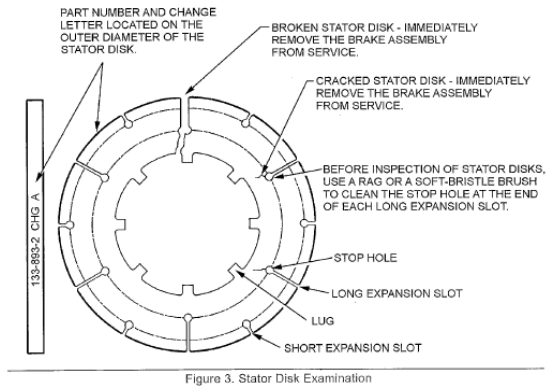


Figure 3. Stator Disk Examination

BA-11

BA-12

On further disassembling of the Brake assembly, One stator disk (towards the piston housing assembly) was found into 4pieces out of which one piece of nearly one inch was found missing as shown in fig.3&4. One torque lug on this stator was found badly bent and other torque lugs found to be slightly bent. One slot on torque plate also observed as slightly damaged. The other stator (which was towards the torque plate assembly) was witnessed with crack just developed on it (fig.7&8). Both the discs the part number and serial number could not be witnessed on the discs. Further, on microscopic inspection, it was observed that the on the broken piece ends, lip shape also formed.

On tyre, scuff marking (flat surface) was observed.

To verify the SB compliance on LH side, LH side brake assembly was also checked and found that on LH side discs also, the compliance of SB could not be identified.

BA-13 (insitu' condition)

BA-14

BA-15 (stator disc crack developed)

BA-16 (other stator disc in pieces)

To confirm the compliance status of SB, the issue was taken up with the M/s. Goodrich with the following clarifications:

01. Brake discs (Stator & Rotor) were found free and rotating. No sign of overheat/fusion observed. Brake Wear indicators were found in good condition and well within limit.

02. One stator towards pressure plate was found broken into four pieces in which one piece of about one inch was found missing. One torque lug on this stator was found badly bent and other torque lugs found/suspected to be slightly bent. One slot on torque plate observed as slightly damaged. It may be assumed that this stator was trying to move. Another stator (Not broken) also found with a minute crack at one Thermal Expansion Slot.

03. The bearings, transducer drive clip and other accessories were found physically in quite a good condition.

M/s. Goodrich has replied that Goodrich brake assembly 2-1528-6 has a history of cracked and broken stators. By 2000, Goodrich had made design and processing changes that eliminated the causes of these issues. Therefore, stators with change letter "B" or later were not subject to the AD. All brakes overhauled by Goodrich since the issuance of Goodrich Service Bulletin 797 originally issued in 2000 have included stators with change letter "B" or later. In 2004, the FAA issued Airworthiness Directive 2004-09-05 that required increased inspection of the stators for this issue. In recent years, Goodrich has received reports of stators with change letter "B" or later that have cracked or broken. Investigation of these stators has revealed that they were exposed to temperatures greater than 1300F. Overheating results in microstructure changes that, with subsequent thermal cycling during service use, can lead to surface cracking, fatigue crack propagation, and eventual disk failure. Goodrich of the opinion that the brake was overheated based on the photographs.

It has been observed that though the brake unit was overhauled in 2009, the marking shows as CHG 'A' only i.e. after the overhaul also, no change of letter 'B' or later version stamped on it. Hence, the component History cards and Job cards from Goodrich Aircraft Wheels and Brakes, USA for the brakes Part No.2-1528-6 bearing S.Nos. 1). S.No.0381R, 2). S.No.0690R, 3). S.No.1155 & 4). S.No.0459R Were demanded. However, no report received from the M/s. Goodrich, USA till submission of report.

As per the SB 2-1528-32-2, if the brake assembly has one or more stator disks that are identified with no change letter or with change letter "A", make an entry into the maintenance log to inspect the brake assembly at an intervals as specified under 1.E.(3) of SB. However, no entry made by the operator with this effect. Hence, no inspection was carried out.

As per the maintenance manual, inspection to be carried out at 425landings and replacement at 749landings as per task card no. 32-42-01-210. Till the time of accident the aircraft had carried out 3426 (excluding the accident landing) landings. i.e. 461landings after replacement of brakes.

As per the task no. 32-42-01-210, no inspection was called for in the task card, for checking crakes/ broken stators.

1.17 ***Organizational and management information:-***

M/s. AR airways (Club One Air) is an Indian air charter company holding valid Non-scheduled Operator Permit (NSOP) permit. M/s. AR airways own a fleet of jets like CRJ, Cessna Citation Excel and Cessna Citation C II. It has got operational base in Delhi, Mumbai and Vishakhapatnam.

The fleets are being maintained by M/s. AR Aerotech, Delhi having the DGCA approval to do the maintenance up to Phase-V on Business Jets like Cessna Citation CE-650, CE-560 XL, CE-550/S-II/Bravo and Cirrus & CRJ.

The Maintenance agency do not have approval for disassembling the brake assembly for any inspection for cracks and broken rotors.

As per the program, the Crew, P1 (ALTP Holder) was to undergo IR check, PPC and Route Check and P2 (CPL Holder) was to undergo PPC and Route check with DGCA FOI onboard. Requests for the training applications were submitted by M/s AR Airways on 10th Sept. 2011 for P1 and for P2 on 05th Oct. 2011 on Cessna Citation II as P1 is due on 21st Oct.2011 and P2 is due on 23rd Nov. 2011.

1.18 ***Additional information:-***

1.18.1 Flight Manual Procedure:-

As per the flight manual, If, during landing, a hard brake pedal – no braking condition is encountered, operate the emergency brake system. Maintenance is required before next flight.

It was observed that No emergency brake system was operated by the crew.

1.18.2 Onboard Checklist:-

As per the onboard checklist

A. Before landing:-
Antiskid – Check ON
Flaps – Land
Airspeed – VREF

B. Landing:-

Throttle – idle
Brakes – Apply (After Touchdown)
Speed brake – Extend
Thrust Reversers – Deploy

Though, all the conditions were monitored and complied, no onboard checklists were found complied by challenge and response method.

1.18.3 General

By virtue of aircraft design, there is no Observer seat available in this aircraft. Hence, DGCA FOI accommodated himself at seat no 10, which is behind Co-pilot seat facing rear cabin in front of forward Galley. By sitting in that seat he had to adjust himself to face forward inorder to witness the deck activities. Even than he could able to observe Pilot's activities but not P2 activities. The DGCA, FOI was not wearing headset and seated in the passenger compartment observing all the flying activities.

Cabin crew onboard is termed as customer service executive is also travelling as passenger for Passenger facilitation. However, the person is not a type Qualified and she is being used to carry out cabin crew activities like opening and closing of doors, in-flight passenger services. Further, for a training flight, there is no role to be played by the Customer Service executive/ Cabin crew.

1.19 ***Useful or effective investigation techniques: -*** Nil

2. ANALYSIS:-

2.1 Operational Aspect:-

On 14th Oct. 2011 the aircraft was released for crew Training check flights (RC, IR, PPC) by the technician authorised under CAR 145 with nil snag, correct tyre pressure and adequate fuel & oil onboard.

As per the training program, the Pilot carried out two full stop landing and one go around exercise for his IR and PPC checks including OEI condition.

The aircraft got airborne at Mumbai at 1128UTC to Surat with 2 cockpit crew, one cabin crew and a DGCA FOI for carrying out checks.

The Pilot was subjected to Route check in the Mumbai/ Surat route and carried out first landing at Surat airport at around 1205UTC. After landing, permission was sought for local check flights. However, ATC initially denied permission as watch hour was over. However, on request by the crew, permission was granted to carry out local sorties.

During Pilot's check flights, Thrust Reversers, Speed brakes were functioning normally and no snag was encountered. On his last sortie, after executing go-around, as per the Flight Operation Inspector's direction, controls were transferred to the Co-pilot for his proficiency checks.

After taking over controls from P1, P2 started flying the aircraft. While coming for landing, the aircraft got stabilised at 314ft altitude and the speed was 119kts. With engines were LH73%N1 and RH66%N1 & flaps 40Deg. Aircraft carried out the landing at 104Kts on Rwy22 with 'G' value of 1.42G and the engines were at idle (31/32%). Immediately after one second, when the speed was 99kts, both TRs (RH&LH) found deployed for 4seconds and stowed back at 82Kts. Within 2seconds, at speed of 76Kts with heading of 234 Deg, 7Deg. Roll to the RH side was experienced by the aircraft. Immediately in the next second, at 72Kts of forward speed, 1.85G was found recorded and only Left side Thrust Reverser found deployed for eleven seconds and the roll towards RH side was recorded as 12Deg.

The aircraft landed with 1.42G. However, during its runway excursion ground run, the aircraft ran over uneven surfaces and entered into Tax jiway and then again it went into unpaved surfaces. Further during its ground run, the RHMLG hit the Taxiway fixture & light and broken it. Most probably the maximum G values found recorded in the DFDR due to the above reasons.

Initially, LH engineN1 was 8%more than the RH engineN1. However, approx. 20sec. prior to the touchdown, LH engine N1 reduced to approx. 5% and at the time of touchdown both the engines were at idle.

From the CVR tape transcript, it has been observed that just above the 500ft auto callouts, aircraft requested Surat ATC for a Missed Approach. However, ATC denied the permission and informed the aircraft to carry out full stop landing on rwy22. Just four second after 400ft auto call, the aircraft was prepared for full stop landing. After 200 ft auto call, P1 has told P2 to align with the centre and settle down. After 100ft auto call, P1 told P2 to reduce little throttle and get down. After 50ft autocall, P1 said ok and asked him to stay in centre. After 9 seconds of the 20ft auto call, the aircraft landed and within 5seconds, FOI shouted to push the rudder. Immediately, there was a sound similar to crash. After 16seconds after that there was an auto call of pull up pull up and that was the last call recorded in the CVR.

P1 observed that the co-pilot was maintaining little high power initially and later on i.e. after 200ft (auto call), as per P1, Vref was already attained and P2 was to be in the centre line. At 100 feet (Auto call) & 50feet (Auto call) the P1 advised P2 to reduce throttle, a little and descend. Just prior to the 20feet (auto call), as per the P1, the aircraft was in the centre and asked the Co-Pilot to stay in centre. Though, before landing, landing checklist was found complied, however, there was no checklist calls were found recorded in the tape in the form of challenge and response.

From tape transcript, further it is also evident that, FOI was not aware of the MA denial by ATC and the crew were going to carry out full stop landing instead of Missed approach (MA). Hence, around 200 feet auto call, FOI asked the crew to hold on and not to descend.

From the above, it could be deduced that on final, the aircraft initially was little high power and it was reduced by P2 as advised by Pilot and during the time of touch down, the aircraft was aligned with proper approach speed, full flaps and aligned with the centreline and the engines power were idle and to the RH side roll attitude was 2Deg. Immediately upon touchdown at 1.42G, roll attitude towards RH side of the aircraft went to 3Deg and both the Thrust Reversers (Left and Right) found deployed for 4 seconds. After a gap of 3seconds, only LH side TR was deployed and the roll attitude increased to 7Deg on the RH side of the aircraft and attained max of 12Deg. This shows that RH side of the aircraft had experienced slight dip initially and went to maximum of 12Deg due to RH side wheel lock (tyre scuff) and subsequently, tyre deflation took place.

Immediately upon landing the aircraft started skidding to the RH side. When the aircraft was skidding out of runway, the aircraft was taken over by Pilot. Thrust reversers were found operated however as the aircraft was not controllable and it was continuing skidding to the right, both thrust reversers were retracted and only LH side thrust reverser was used immediately to bring the aircraft into the runway. However, by the time the aircraft went out of runway.

Initially, Missed approach was planned by the FOI. However, as permission was denied by Surat ATC due LLR departure, Missed Approach was converted in to full stop landing.

As there is no observer seat in the cockpit area, DGCA Flight Operation Inspector sat on the passenger seat no.10 which is in the passenger cabin facing rear-side behind the Co-pilot seat. FOI was monitoring the flying activity from that seat only.

2.2 Maintenance Aspect:-

During the RH side of Main Landing gear tyre and brake assembly inspection at DGCA, Hqrs, Brake Stators and rotors were found rotating and no sign of overheating observed. Brake Wear indicators were found in good condition and well within limit.

On further disassembling of the Brake assembly, one stator towards pressure plate was found broken into four pieces in which one piece of about one inch was found missing. One torque lug on this stator was found badly bent and other torque lugs found to be slightly bent. One slot on torque plate observed as slightly damaged. This shows that that stator was trying to move due to missing piece of the stator. Another stator (Not broken) also found with a minute crack at one Thermal Expansion Slot.

On both the discs, the part number and serial number were not available. Further, on microscopic inspection, it was observed that on the broken piece ends, lip shape was formed.

The bearings, transducer drive clip and other accessories were found physically in quite a good condition.

On tyre, scuff marking (flat surface) was observed.

As per the GOODRICH SERVICE BULLETIN 2-1528-32-2 on "Landing Gear – Brake Assembly – Possible Cracked Stator Disks" issued in Feb.19.2003, there were reports of broken stator disks in brake assembly. Further, it has stated that if the brake assembly was overhauled by Goodrich after March 2000, this service Bulletin was completed and the latest Stator disks are installed. Even though, the Brake assembly was overhauled by M/s. Goodrich in 2009, during inspection on brake assembly, the compliance of SB could not be identified. There was a letter "A" stamp making appeared on the brake.

To verify the SB compliance on LH side, LH side brake assembly was also checked and found that on LH side discs also cracks and broken pieces were observed and the compliance of SB could not be identified.

As per the SB 2-1528-32-2, if the brake assembly has one or more stator disks that are identified with no change letter or with change letter "A", make an entry into the maintenance log to inspect the brake assembly at an intervals as specified under 1.E.(3) of SB. However, no entry made by the operator with this effect. Hence, no inspection was carried out.

As per the maintenance manual, inspection to be carried out at 425 landings and replacement at 749 landings as per task card no. 32-42-01-210. However, there was no inspection check found for checking cracks or broken stators. Till the time of accident the aircraft had carried out 3426 (excluding the accident landing) landings. i.e. 461 landings after replacement of brakes.

As per the maintenance records, it has been observed that no records are maintained for the compliance of SB. As per the SB, if the stamp making is of ' – ' or 'A' the brake system to be inspected for cracks or broken pieces for every 376landings as per SB and as per AMM, inspection is to be carried out for every 425landings.

Also the maintenance agency did not have approval for disassembling the brake for carrying out visual inspection to comply the SB.

Hence, there is a lapse on maintenance inspection observed. As the discs found broken and in pieces, the broken piece might have stopped the free rotation of the wheel as identified by the Goodrich SB.

2.3 Weather Aspect:-

The aircraft at 1136UTC, first came in contact with Surat ATC and the Weather prevailed at the time was; wind 340/04, visibility 6 Kms., sky clear, Temp:34 & QNH 1007HPa. When VT-CLC was cleared to land on Rwy 22, at around 1229UTC, the weather prevailed during the time of landing was; 340/04kts.

There was no significant weather change prior to and during the time of accident. Hence, the weather was not a factor in this accident.

2.4 Other Aspects:-

As per the tyre marks witnessed on the runway, immediately after landing, discontinuous RH side tyre marks were observed. Later on it turned in to continuous markings. There is a slight directional change of tyre marks observed towards the runway centre. This is due to the differential Thrust reverser application. However, due to tyre deflation, the aircraft went out of runway. There is a dip in the roll attitude of the aircraft, which denotes that there is a tyre deflation.

Cabin crew onboard termed as 'customer service executive' has also travelled as passenger for Passenger facilitation. However, the person is not a type Qualified and she is being used to carry out cabin crew activities like opening and closing of doors, in-flight passenger services. Further, for a training flight, there is no role to be played by the Customer Service executive/ Cabin crew.

On that day, Surat ATC watch Hours was from 0800UTC to 1200UTC. Block time of Mumbai to Surat is Approx. 40minutes. The aircraft got airborne from Mumbai at 1128UTC and carried out its first landing at 1206UTC.

Though the operator is aware of the training program for their crew at Surat, the operator did not get approval for extension of watch hour of Surat ATC in coordination with the operating crew prior to the departure at Mumbai.

The Rwy inspection revealed that there was no Foreign Object Damage.

3. CONCLUSIONS:-

3.1 Findings:-

1. The aircraft was released at Mumbai by the technician authorised under CAR 145 in serviceable condition.
2. The aircraft was having valid C of R, and C of A.
3. Crew were having valid licences and class-I medical.
4. The DGCA FOI was carrying out the Route Check and Proficiency Checks of the Crew.
5. The aircraft was released with 4400lbs. of fuel onboard at Mumbai and C.G was within the Limit.
6. The aircraft got airborne at 1128UTC from Mumbai.
7. The aircraft landed at Surat beyond watch hours, and no action was carried out by the Operator to extend watch hours of Surat ATC.
8. During the time of landing of the accident flight, co-pilot was carrying out landing.
9. Landing checklist was not carried out by the crew before landing in the way of challenge and response.
10. The aircraft during the time of touchdown was under visual flying and the aircraft aligned with centre of the RWY22 and the flaps were 40°, engines were idle.
11. Immediately after landing, RH tyre deflation took place, probably because of the broken brake stator disc, which affected the free rotation of the wheel.
12. The aircraft veered to the right and entered into Kacha. RH main landing gear sheared off and aircraft was substantially damaged.
13. Though the brake units were overhauled by the M/s. Goodrich & released in 2009, there was no compliance of SB status stamped on the brake assembly and it was holding 'A' status only.
14. The Stator discs did not have any part number and serial numbers stamped on it.
15. The aircraft brakes scheduled inspection task card does not cater for the inspection of brake disc cracks/ broken pieces as notified in the SB. Hence, Maintenance of Brake system was not carried out by M/s AR Airways as per schedule.
16. Unapproved cabin crew was carried in the aircraft for passenger facilitation.
17. Weather prevailing during the time of accident was not a factor.

3.2 Probable cause of Accident :-

During landing roll, RH Main Wheel got locked-up due to broken brake stator disc which resulted into drifting of the aircraft and Runway Excursion.

4. SAFETY RECOMMENDATIONS:-

1. Appropriate action can be taken against the Operator for their maintenance lapses.
2. The operator to be asked to amend task card as per the applicability.

3. Appropriate corrective actions to be taken against the crew for not following Landing Checklist by the way of Challenge and Response and did not use the emergency brake as specified in the flight manual.
4. Appropriate action to be taken against the operator for utilising the unapproved cabin crew.
5. Operator to be advised to carry out proper planning for watch hours during flying activities.
6. Matter may be taken up with the brake overhaul agency M/s. Goodrich for the following deficiencies;
   a. Reason for non availability of part number and serial number on the discs.
   b. Reason for not upgrading to CHG "B" or later version even though it was overhauled after year 2000.
   c. To provide safety measures/ guidelines for subsequent departures within short duration to avoid failure of breaks due overheating if any.

(R.Rajendran)
Inspector of Accident to VT-CLC

Mumbai – 29.
10/09/2013