Aviation Investigation Final Report

Location:	Palmer, Alaska	**Accident Number:**	ANC05LA123
Date & Time:	August 12, 2005, 15:00 Local	**Registration:**	N63EB
Aircraft:	Brabandt RV-9A	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The commercial certificated pilot was landing a tricycle gear-equipped kit-built experimental airplane on a private airstrip that had an uneven dirt/gravel surface. During the landing roll, the nose landing gear began producing scuff marks on the runway surface that became progressively deeper. The nose gear strut and fork eventually dug into the runway, and the nose landing gear strut was bent aft. The airplane nosed over, and received structural damage to the fuselage, left elevator, left wing, rudder, and vertical stabilizer. An exam of the runway revealed surface undulations in the area where the nose wheel fork assembly began to scuff the tops of the undulations, producing slight gouge marks that increased in depth and ended where the nose fork dug into the ground. There were no skidding signatures or evidence that the main landing wheel tires were locked before the airplane nosed over. An exam of the airplane revealed that the nose gear strut was bent aft and upward from its normal geometry. The nose fork assembly is comprised of a metal swiveling housing block, attached to the lower end of the threaded strut by a nut. The bottom edge of the threaded nose fork strut is about 4 inches from the ground. A teardrop-shaped fiberglass wheel pant enclosed the accident airplane's nose fork assembly and upper portion of the nose wheel and tire. The distance from the bottom of the wheel pant and ground is about 2 and 7/16 inches. Staff examined data for 18 recent accidents and one incident in which Vans Aircraft series RV-6A, RV-7A, RV-8A, or RV-9A airplanes have become inverted during landing. Several involved hard touchdowns, bounced landings (six), or landing in a slip. Several others involved off-field landings in rough terrain, hitting a ditch, or going down an embankment. Four of the accidents and one incident involved a touchdown and the start of a rollout on an unpaved runway, followed by the nose gear folding back. The airplanes would then slide for varying distances before nosing over. Staff also examined data for four additional incidents in which the nose gear collapsed during taxi but the airplane did not nose over. These nine accidents and incidents occurred on various unpaved surfaces including gravel, turf, soft turf, hard surface with "washboard" bumps, and slight depressions, and they all involved the nose gear strut and fork digging into the ground and the nose gear bending aft. The kit manufacturer posted a letter on their

website stating that their review of NTSB accident reports pointed to pilot proficiency as the most significant factor. The letter said the company has produced a lighter weight leg/fork combination, with increased clearance between the nose strut axle.

The NTSB's Structures Study is available at the following address: http://www.ntsb.gov/publictn/2006/RV_Study.pdf . The NTSB's Photos and Data report that provides details on all of the RV nose-over accidents and incidents can be found at the following URL address: http://www.ntsb.gov/publictn/2006/RV_Photos.pdf.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The loss of nose gear strut/fork-to-ground clearance that led to the collapse of the nose gear strut and nose-over during the landing roll. Factors contributing to the accident were an uneven dirt/gravel surface runway.

Findings

Occurrence #1: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER
Phase of Operation: LANDING - ROLL

Findings
1. (F) TERRAIN CONDITION - ROUGH/UNEVEN

Occurrence #2: NOSE GEAR COLLAPSED
Phase of Operation: LANDING - ROLL

Findings
2. (C) LANDING GEAR,NOSE GEAR STRUT - BUCKLED

Occurrence #3: NOSE OVER
Phase of Operation: LANDING - ROLL

Factual Information

On August 12, 2005, about 1500 Alaska daylight time, a tricycle gear-equipped homebuilt experimental Brabandt RV-9A airplane, N63EB, sustained substantial damage when it nosed over during the landing roll at a private airstrip, about 6 miles west of Palmer, Alaska. The airplane was being operated as a visual flight rules (VFR) local area personal flight under Title 14, CFR Part 91, when the accident occurred. The airplane was operated by the pilot. The commercial certificated pilot, the sole occupant, received minor injuries. Visual meteorological conditions prevailed. The flight originated at the Palmer Airport about 1450, and no flight plan was filed.

During a telephone conversation with the National Transportation Safety Board (NTSB) investigator-in-charge (IIC), on August 15, the pilot reported that he landed with full flaps on runway 21 at the Cardwell Airstrip, a gravel/dirt surfaced runway, which is about 1,200 feet long, and about 50 feet wide. He indicated that he had landed at the airstrip several times before the accident. He said his touchdown speed was about 58 mph, and he touched down about 20 feet from the end of the runway. He said that several seconds later, he felt what seemed to be the nose wheel dragging, and shortly thereafter, the nose wheel seemed to drag again, but much harder. The airplane subsequently nosed over, and received structural damage to the fuselage, the left elevator, the left wingtip, the rudder, and the vertical stabilizer. The pilot indicated that his inspection of the runway surface revealed that about 500 feet after touchdown, the nose wheel landing gear began producing scuff marks on the runway surface that became progressively deeper. The nose gear strut and fork eventually dug into the runway surface, and buckled the nose landing gear strut aft.

The pilot indicated that he is the builder of the kit-supplied airplane, and has accrued about 115 hours in the airplane. The kit was produced by Van's Aircraft, Inc., Aurora, Oregon. The pilot said the nose wheel tire is a 4:00 X 5 size, and the wheel is free-castering. The spring steel nose gear strut angles forward and downward from its upper attach point. The nose fork assembly is comprised of a metal swiveling housing block, attached to the lower end of the threaded strut by a nut. The forward rectangular face of the swivel housing is flat, and vertically oriented. The bottom edge of the nose fork assembly is about 1 and 1/8 inches above the bottom of the strut. The distance from the ground to the bottom of the strut where the retaining nut is installed is about 4 inches. The nose wheel and tire are retained by a bolt through two triangular-shaped side plates that extend aft of, and on either side, of the swivel housing. The accident airplane's nose fork assembly and upper portion of the nose wheel and tire were enclosed by a teardrop-shaped fiberglass wheel pant, and the upper, forward-facing surface of the strut was covered by abrasion tape. The distance from the bottom of the wheel pant to the ground is about 2 and 7/16 inches.

The airplane and the landing airstrip were examined by an NTSB Air Safety Investigator on

August 16. The examination revealed that the nose gear strut was buckled aft and downward from its normal geometry. The forward end of the nose gear wheel pant was broken. The forward face and lower edge of nose fork assembly, and the lower end of the bolt, was encrusted with dirt and had scuffing and abrasion marks on the housing. The tape applied to the gear strut, just above the nose fork assembly, was torn and abraded.

The dirt/gravel surface airstrip was dry. Slight, uneven surface undulations were noted in the area where the nose wheel fork assembly began to scuff the tops of the undulations, producing slight gouge marks that began about 500 feet from the approach end of the runway. The gouge marks increased in depth toward the end of the runway, and ended where the nose fork dug into the ground. There were no skidding signatures or evidence that the main landing wheel tires were locked before the airplane nosed over.

Staff has examined data for 18 recent accidents and one incident in which Vans Aircraft series RV-6A, RV-7A, RV-8A, or RV-9A airplanes have become inverted during landing. Several involved hard landings such as hard touchdowns, bounced landings (six), or landing in a slip. Several others involved off-field landings in rough terrain, hitting a ditch, or going down an embankment.

Four of the accidents and one incident involved a touchdown and the start of a rollout on an unpaved runway, followed by the nose gear folding back. The airplanes would then slide for varying distances before nosing over. Staff also examined data for four additional incidents in which the nose gear collapse during taxi but the airplane did not nose over. These nine accidents and incidents occurred on various unpaved surfaces including gravel, turf, soft turf, hard surface with "washboard" bumps, and slight depressions. These nine cases involve the nose gear strut and fork digging into the ground and the nose gear bending aft.

Van's Aircraft Inc., posted a letter on their company website, dated March 10, 2005, concerning nose gear and nose wheel fork issues. The letter indicated that over the history of the company's products, the number of operational kit-built tricycle gear airplanes has increased, along with an increase in damage to the nose gear. The company stated that their review of NTSB accident reports pointed to pilot proficiency as the most significant factor. The letter said the company has produced a lighter weight leg/fork combination, with increased clearance between the nose strut axle and the ground, which may be beneficial in certain extreme operating conditions; however, there was no data indicating that increased clearance at the axle would reduce the likelihood of a nose gear failure. The company indicated that the new leg/fork combination was being shipped with current finish kits, but they had insufficient data to warrant a recommendation to replace any nose gear components on aircraft currently flying. The letter closed with a statement that said, "Ensuring correct tire pressure, adequate wheel fairing-to-tire clearance, correct axle nut torque, and exercising proper pilot technique are the best way to prevent any problem with the nose gear."

During a telephone conversation with the president of Van's Aircraft Inc. on December 14, 2005, he indicated that the redesigned leg/fork combination increases the distance from the

ground to the bottom of the nose gear strut to about 5 inches. The ground-to-wheel pant distances remain unchanged. The president of Van's Aircraft also indicated that the nose wheel assembly on their new four-place kit airplane would have a different design.

A Structures Study and examination of several RV nose over accidents found that a number of factors or combinations of those factors, can lead to the loss of ground clearance for the nose gear strut and fork. Factors may include poor piloting technique, bounced landings, low tire pressure, heavier engine/propeller combinations, forward center of gravity, soft ground, heavy braking, high grass, undulating ground, and depressions in or objects on the runway.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	75,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 1, 2005
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 1, 2004
Flight Time:	2115 hours (Total, all aircraft), 115 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Brabandt	**Registration:**	N63EB
Model/Series:	RV-9A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	90057
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	August 1, 2005 100 hour	**Certified Max Gross Wt.:**	1800 lbs
Time Since Last Inspection:	15 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	115 Hrs as of last inspection	**Engine Manufacturer:**	Superior
ELT:	Installed, not activated	**Engine Model/Series:**	XP-360
Registered Owner:	Earl W. Brabandt	**Rated Power:**	180 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Palmer, AK (PAAQ)	**Type of Flight Plan Filed:**	None
Destination:	Palmer, AK (34AK)	**Type of Clearance:**	None
Departure Time:	14:50 Local	**Type of Airspace:**	

Airport Information

Airport:	Cardwell Strip	**Runway Surface Type:**	Dirt;Gravel
Airport Elevation:	490 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	21	**IFR Approach:**	None
Runway Length/Width:	1200 ft / 50 ft	**VFR Approach/Landing:**	Full stop

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	61.621665,-149.286392

Administrative Information

Investigator In Charge (IIC):	Erickson, Scott
Additional Participating Persons:	John Harrington; FAA AL-ANC FSDO 03; Anchorage, AK
Original Publish Date:	June 27, 2007
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=62211