Aviation Investigation Final Report

Location:	West Milford, New Jersey	**Accident Number:**	ERA11LA390
Date & Time:	July 9, 2011, 12:39 Local	**Registration:**	N111XN
Aircraft:	Aero Vodochody L39C	**Aircraft Damage:**	Substantial
Defining Event:	Runway excursion	**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While landing on runway 24 at an airport that had obstructions on both ends of the runway, had only 3,471 feet of usable runway available, and which required a 3.50 degree glideslope for landing, the pilot of the ex-military jet trainer landed the airplane and overran the runway. According to the pilot's written statement, during the landing he touched down 5 to 6 feet prior to the painted "24" on the runway. He then lowered the nose of the airplane and "retracted" the wing flaps. He then pushed the control stick forward and applied the brakes by squeezing the control-stick-mounted brake handle, but braking did not occur. He then applied the brakes a second time, extended the speed brakes, wiggled the control stick, and pushed the control stick forward and applied the brakes a third time without result before applying them a fourth time. He then felt the anti-skid engage. The airplane then struck a chain link fence and went over an embankment before impacting the ground, nosing over, and coming to rest inverted. The pilot was seriously injured during the impact sequence and the airplane incurred substantial damage to the forward fuselage.

Review of the pilot's statement also revealed that he had not touched down at 96 knots indicated airspeed, as specified by the landing speeds chart, but had touched down at 106 knots, which would have extended his landing distance by about 20 percent. Further, witnesses observed the airplane actually touch down about 300 to 400 feet past the painted "24" on the runway, not the 5 to 6 feet prior to the painted "24" as stated by the pilot. Skid marks that matched the width of the airplane's main landing gear geometry were also present on the runway surface. The marks started about 1,270 feet past the painted "24" on the runway and continued until they left the pavement.

Review of performance planning charts also revealed that the safety margin for operating at the airport was insufficient: even if the airplane had touched down just prior to the painted "24" on the runway, the pilot would already have 205 feet of the usable runway behind him, and with moderate braking the landing roll would have been about 2,500 feet, and the landing distance, when landing over a 50 foot obstacle, would have been about 3,370 feet. With intensive braking, the landing roll would have been about 2,000 feet, and the landing distance, when landing over a 50 foot obstacle, would have been about 2,900 feet. The pilot also would not have met the accelerate/stop criteria for takeoff or a balked landing, as the airplane required 3,600 feet to accelerate to takeoff speed and then stop after an aborted takeoff.

Examination of the airplane did not reveal any evidence of a preimpact mechanical failure or malfunction that would have resulted in failure of the normal braking system. The flaps were also in the 44 degree (landing) position and had not been retracted, as was required for a minimum run landing to reduce lift, increase weight on the wheels, and reduce tire skidding. Examination of the flight manual also revealed that, in the event of a brake failure, activation of the main wheel brake units still would have been possible if the pilot had operated the emergency brake lever. According to the flight manual, he should have used the emergency brake lever if he believed that he had lost normal braking.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The pilot's excessive airspeed and failure to attain the proper landing point, which resulted in the airplane touching down too fast and too far down the short runway. Contributing to the accident was the pilot's failure to retract the flaps after landing, which resulted in delayed brake activation, the pilot’s decision to land on a runway with an insufficient safety margin for the landing conditions, and the pilot’s failure to use the emergency brake lever.

Findings

Aircraft	Airspeed - Not attained/maintained
Personnel issues	Incorrect action performance - Pilot
Aircraft	Surface speed/braking - Attain/maintain not possible
Aircraft	TE flap control system - Incorrect use/operation
Aircraft	Descent/approach/glide path - Not attained/maintained
Personnel issues	Decision making/judgment - Pilot

Factual Information

History of Flight

Landing	Landing area overshoot
Landing-landing roll	Runway excursion (Defining event)
Landing-landing roll	Collision during takeoff/land

HISTORY OF FLIGHT

On July 9, 2011, at 1239 eastern daylight time, an Aero Vodochody L-39C, N111XN, incurred substantial damage during a landing overrun at Greenwood Lake Airport (4N1), West Milford, New Jersey. The certificated private pilot was seriously injured. Visual meteorological conditions prevailed, and no flight plan was filed for the Title 14 Code of Federal Regulations Part 91 personal flight that departed from Orange County Airport (MGJ), Montgomery, New York.

According to the pilot, he departed MGJ at 1220 for 4N1. While he was approaching 4N1 there was one other airplane in the traffic pattern that was going to land on runway 6. The pilot checked the winds and determined that due to a crosswind it would be more favorable for him to land on runway 24. He then radioed his intention to land on runway 24 and asked the pilot of the other airplane to notify him when he had cleared the runway.

Once he was notified that the other airplane had cleared the runway, the pilot flew over the airport at midfield and entered the traffic pattern for landing on runway 24. He then set the wing flaps to the full extension position and reduced his airspeed. He touched down 5 to 6 feet prior to the painted "24" on the runway at approximately 106 knots indicated air speed (IAS). The pilot then lowered the nose of the airplane and "retracted" the wing flaps. He then pushed the control stick forward and applied the brakes by squeezing the control stick mounted brake handle but, braking did not occur. He then let go of the handle and checked to make sure that the hydraulic pressure was at 135 kiloponds per square centimeter or more. He then applied the brakes a second time but there was still no braking and he was now almost half way down the runway.

He contemplated "pushing power" but did not, as he thought it was too risky. Instead, he continued to allow the airplane to slow down. The pilot then extended the speed brakes, wiggled the control stick, and pushed the control stick forward and applied the brakes for a third time. At this point he had only 25 percent of the runway remaining and his airspeed was indicating 95 knots. He then applied the brakes for a fourth time and felt the antiskid system engage. He then looked to his left and observed that there was a hill and trees, and that the area was clear so he applied left rudder and steered the airplane to the left as he was concerned their might be residences straight ahead of him. He then saw a fence. The airplane then struck the fence and traveled through it at approximately 80 knots IAS. The airplane then came to rest inverted with the engine still running. The pilot attempted to shutdown the engine but due to the damage to the airplane and his injuries, he was unable to shut it down. The engine eventually shutdown by itself and the pilot was extricated approximately 2 hours later from the forward cockpit by public safety personnel after deactivating the ejection seat and cutting away a log which was wedged against his chest.

According to witnesses who observed the airplane moments before the accident, the airplane appeared to be moving quickly prior to touching down on runway 24 and though witnesses differed as to the exact touchdown point of the airplane the preponderance of witness statements revealed that it touched down approximately 300 to 400 feet past the painted "24" on the runway.

PERSONNEL INFORMATION

According to Federal Aviation Administration (FAA) records, the pilot held a private pilot certificate with a rating for airplane single-engine land, airplane multi-engine land, and instrument airplane. He also possessed an authorization from the FAA which allowed him to operate the L-39 under visual flight rules. His most recent FAA third-class medical certificate was issued on June 29, 2011. He reported that he had accrued 1,700 total hours of flight experience, 60 of which were in the L-39.

AIRCRAFT INFORMATION

The accident airplane was a two seat, pressurized, subsonic jet trainer of conventional metal construction, capable of traveling at speeds in excess of 400 knots.

It was powered by an Ivenchenko AI-25TL turbofan engine that produced 3,850 pounds of thrust at maximum rpm. It did not have a thrust reverser and at idle would produce 297 pounds of thrust.

It was equipped with air brakes, hydraulically actuated wheel brakes, an antiskid system, and an emergency braking system. It was also equipped with two VS-1-BRI rocket assisted ejection seats which in addition to being operable when airborne were also operable on the ground down to a speed of 81 knots.

According to FAA and maintenance records, the airplane was manufactured in 1989. It was operated by the Kyrgyz Republic Air Force along with 95 other L-39s that were obtained from the former United Soviet Socialist Republic. It was deregistered on March 19, 1999 by the Kyrgyz Republic Ministry of Defense, and then was imported into the United States. After passing through several owners, it was purchased by the pilot on November 3, 2009.

The airplane’s most recent conditional inspection was completed on March 15, 2011. During that inspection the airplane's brakes were removed and replaced. At the time of the inspection, the airplane had accrued 659.6 total hours of operation.

METEOROLOGICAL INFORMATION

The recorded weather at 4N1 at 1239, included: wind 190 degrees at 5 knots, visibility 10 miles, sky clear, temperature 27 degrees C, dew point 21 degrees C, and an altimeter setting of 29.88 inches of mercury.

AIRPORT INFORMATION

Greenwood Lake airport was uncontrolled and had one runway, 06/24. The runway was asphalt, and in good condition. The total length was 4,000 feet long and 60 feet wide. It was marked with nonprecision markings that were in good condition

Usable length for landing on runway 24 was 3,471 feet due to a displaced threshold on the end of runway 06, marked as a taxiway aligned with a runway, and a chevroned runway safety area on the end of runway 24.

A 2-light precision approach path indicator installed on the left side of runway 24 displayed a 3.50 degree glide path.

Obstructions existed on the approach path in the form of trees. A 23 foot high tree existed 230 feet from the runway, 132 feet left of the centerline, which took a 1:1 slope to clear, and a 17 foot high tree, existed 95 feet from the approach end, 90 feet left of the centerline.

A cliff existed on the departure end and trees were present both below the runway's altitude, and 192 feet in height above it, 1,988 feet from the departure end, and 170 feet right of the centerline. A 9:1 slope was required to clear them.

WRECKAGE AND IMPACT INFORMATION

Examination of the runway revealed that skid marks which matched the width of the L-39s main landing gear geometry were visible on runway 24. Further examination revealed that the skid marks started approximately 1,270 feet past the painted "24" on the runway, and continued until they left the end of the paved portion of runway.

Examination of the accident site revealed that after leaving the runway, the airplane struck a 4 foot high chain link security fence at the edge of the runway, struck a small tree, went over an embankment then impacted terrain and nosed over, coming to rest in a gully upside down, with the nose of the airplane facing the departure end of runway 24, with an approximate 40 foot section of the security fencing laying next to it.

Examination of the wreckage revealed that the nose section of the airplane was crushed back to the approximate location of the forward cockpit and the nose wheel landing gear assembly was covered with dirt.

Further examination revealed that landing gear was extended, the gear doors were open, and the ram-jet turbine was in the extended (deployed) position. The flaps were in the landing position, and there was foliage in the flap slots and flap stowage wells. Dirt was also splattered on their lower panels.

TESTS AND RESEARCH

Hydraulic System

The airplane's hydraulic power supply system was comprised of both a main and emergency system.

The main system provided the hydraulic pressure necessary to operate the landing gear, wheel brakes, wing flaps, airbrakes, and the ram-jet turbine. The main supply system consisted of a reservoir, an engine driven variable flow hydraulic pump, filters, a relief valve, and a pressure accumulator.

The emergency system provided the hydraulic pressure required for emergency extension of the landing gear, wing flaps, and the ram-jet turbine in an emergency and also for the operation of the emergency brake.

The main and emergency systems were separated by a solenoid operated valve preset to a certain value. The main system would charge the emergency system when the landing gear was extended and the pressure in the main system would rise above 95 kiloponds per square centimeter. With retraction of the landing gear after takeoff, charging of the emergency system would stop until the landing gear was once again extended.

Both the main and emergency systems were also fitted with a pressure indicating system connected to two pressure gauges labeled "MAIN" and "EMERGENCY" located in the right rear console of the cockpit.

Ram-Jet Turbine and Landing Gear System

According to the L-39C flight manual, the ram-jet turbine used pressure from the main hydraulic system for extension and retraction and would provide an alternate source of electrical power in the event of a failure of the engine driven main generator. It would extend automatically whenever there was a drop in the airplane's main voltage and would automatically retract if the main voltage was restored, the nosewheel contacted the runway de-activating the weight-on-wheels (WOW) switch, or during emergency ground retraction of the landing gear. It also could be extended by means of an emergency lever located in the cockpit.

The landing gear system provided normal and emergency extension of the airplane's landing gear. Hydraulic pressure for operation of the landing gear was supplied by the hydraulic system through a selector valve which was electrically controlled by the landing gear lever. The gear doors would automatically close after either extension or retraction of the landing gear except during emergency extension in which case the doors would remain open.

Examination of post accident photographs of the wreckage revealed that during the impact sequence the forward portion of the fuselage had been crushed back into the right side console in the cockpit and had come into contact with the emergency extension lever for the standby generator (the ram-jet turbine) and the emergency extension lever for the under carriage (landing gear), and both levers had been forced aft to their activated (extended) positions.

Wing Flap System

The wing flaps were a two panel, slotted, fowler flap type system, with one panel being mounted on the inboard trailing edge of each wing. They were hydraulically operated and electrically controlled. Both wing flaps were interconnected by a single actuating cylinder. Synchronization of both the left and right flap panels was executed mechanically. They could be set to one of three positions ("ZERO", "25", or "44"). These flap positions corresponded to control buttons located on the left side console in the cockpit which were labeled: "UP 0°", "TAKE OFF 25°", and "LAND 44°".

After activation by the pilot, the "FLIGHT" and "TAKE-OFF" buttons would return to their initial position after the hydraulic system had extended or retracted the flaps to the selected position. The button for "LANDING" would return to its initial position 2 to 3 seconds after the flaps would reach their 44 degree position for landing. This return of the "LANDING" button to its initial position would only occur after the left elevator trim tab had reached its down position.

Trim System

A trim system provided the pilot with the ability to trim the airplane along both the longitudinal and lateral axis using a five-position spring-loaded switch located on top of the control stick.

Longitudinal trimming of the airplane by the pilot was provided by a trim tab mounted on the right elevator panel.

The trim system would also automatically deflect the left elevator trim tab down when the wing flaps would move from the 25 degree position to the 44 degree position.

Both trim tabs were operated by an electric actuator which deflected the tabs up or down.

Position of the trim tabs could be verified in the cockpit by use of an indicator which consisted of a top-viewed miniature airplane, a graduated scale, and a pointer, which would display a nose-up or nose-down attitude that was proportional to the amount of trim tab displacement.

With flap retraction after landing, the left elevator trim tab would move automatically back to its neutral position.

Review of post accident photographs of the airplane's empennage revealed however, that the left elevator trim tab was in the down position.

Main Brake and Anti Skid Systems

The main brake system was fed by the main hydraulic system. It consisted of a pressure reducer valve and one main brake control valve connected to brake levers on the control sticks in both cockpits, two disc brake units on the wheels of the main landing gear, and two pressure relief valves (one for each side), which were activated by the anti-skid system.

The main brake system would be activated along with the anti-skid system when airplane weight was on the nose landing gear and the WOW switch de-activated.

The anti-skid system was internally adjusted for maximum takeoff weight of the original military equipped L-39 with Barum tubeless tires. Once activated, the anti-skid system would modulate hydraulic pressure delivered to the brakes in order to obtain maximum coefficient of friction between the wheel and the runway for any aircraft configuration, runway condition, and pressure on the control stick mounted brake lever to prevent a locked wheel.

Pressure in the main brake system could be monitored by the pilot on a double pressure gauge, which was mounted in the lower center panel in the cockpit. A single pointer gauge indicated the pressure if the emergency brake lever was activated in either the "PARK" or "EMERG" position.

In case of failure of the hydraulic pump, application of the brakes would still be possible by use of hydraulic pressure stored in the main accumulator as long as main system pressure was above 60 kiloponds per square centimeter.

Review of photographs provided by the FAA revealed that the accident airplane was equipped with tires that were narrower and of a higher profile than the original Barum tires.

Emergency Brake System

The emergency brake system was a separate system which shared only the brake pistons with the normal system.

If no pressure was available in the main system, or the WOW switch did not sense that the airplane's weight was on the nose landing gear or the anti-skid system failed, operation of the main wheel brake units was still possible using pressure stored in the emergency accumulator by operation of the "PARK and EMERG BRAKE" lever which was located on the left side console in the cockpit. This would port emergency hydraulic system pressure directly to the brake pistons.

According to the manufacturer, if a loss of normal braking action did occur this activation of the emergency brake lever in a gradual manner would then equally and simultaneously apply braking to both main landing gear wheels, by-passing the anti-skid system.

Approach and Landing

According to the pilot, after touchdown the airplane was traveling at speeds that were in excess of the rotation speed of 90 knots indicated airspeed (KIAS) that was required to lift the nose wheel for takeoff and above the 70 KIAS that the flight manual advises to start braking at after lowering the nose to have the nose wheel contact the runway.

According to the flight manual for the L-39C, throughout the final approach phase the pilot should use the airspeed indicator and the runway as primary references, and when established on final approach for landing, engine rpm, should be at 70 percent in order to obtain optimum engine acceleration if required. The threshold should be crossed at 110 KIAS and the pilot should touchdown at 95 to 100 KIAS.

The flight manual also advises that for a minimum run landing the pilot should fly an accurate final approach and touchdown speeds, and after touchdown to lower the nose wheel, retract the flaps, and push the control stick fully forward, and that these actions would put more weight on wheels and reduce tire skidding in the event of an antiskid failure. It also stated to apply the brakes gently in a single smooth application with constantly increasing brake lever pressure as speed decreases.

Furthermore, the manual warned that the pilot should "be prepared to use the emergency brake lever if there is no response from the normal lever", and in the emergency procedures section directed that "in case of normal brake system failure" to "Pull" the emergency brake lever.

Flight Planning

Performance charts were provided in the L-39C flight manual to assist the pilot in planning flights from takeoff to landing in normally encountered conditions (including calculation of touchdown speed) and were based on the operating procedures in the manual.

Review of the landing distance chart revealed that if the airplane had touched down at 96 knots under the conditions that existed at the time of the accident that with "moderate braking" the landing ground run would have been be approximately 2,500 feet and landing distance when landing over a 50 foot obstacle would have been approximately 3,370 feet.

With "intensive braking" the landing ground run would have been be approximately 2,000 feet and landing distance when landing over a 50 foot obstacle would have been approximately 2,900 feet.

Accelerate stop distance, which was the distance required to accelerate to takeoff speed, experience an engine failure, abort the takeoff, and bring the airplane to a stop was approximately 3,600 feet.

Post Accident Examination and Testing

On July 19, 2011 at the request of the owner, an FAA certificated airframe and powerplant mechanic examined the wheel brake cylinders. The mechanic stated that the brake units appeared to be nearly new with very little wear or obvious defects. The housings and the pistons also did not exhibit any evidence of binding or corrosion, the bores were clean, and the pistons moved with applied pressure.

On January 2, 2012 at the request of the owner, testing was conducted at a facility in Germany that specialized in maintenance and training for the L-39. During the testing both anti-skid relief valves were tested along with each brake unit, the reducer valve, the brake control valve, and the brake control valve microswitch. Review of the test report and testing protocols by the NTSB did not reveal evidence of any preaccident anomalies or malfunctions that would have precluded normal operation of the airplane.

Examination of post accident photographs of the brake discs by the NTSB also revealed evidence of bluing of the brake discs which was indicative of the discs being subjected to extremely high temperatures which is a condition that is caused by continued hard stops.

ADDITIONAL INFORMATION

According to FAA and NTSB information, runway overruns during the landing phase of flight account for approximately 10 incidents or accidents every year with varying degrees of severity, with many accidents resulting in fatalities.

FAA and NTSB data indicates that the following hazards increase the risk of a runway overrun:

• A non-stabilized approach,

• Excess airspeed,

• Landing beyond the intended touchdown point, and

• Failure to assess required landing distance to account for slippery or contaminated runway conditions or any other changed conditions existing at the time of landing.

FAA Advisory Circular (AC 91-79)

According to AC 91-79, safe landings begin long before touchdown. Adhering to standard operating procedures and best practices for stabilized approaches will always be the first line of defense in preventing a runway overrun.

The reference landing approach speed is used by pilots as a base from which to calculate speeds used during landing. The reference speed is calculated as a margin over the stall speed. While there are specific circumstances, such as strong gusty wind conditions and potential wind shear environments where adjusting approach speed is appropriate, it is often done in an arbitrary manner that adversely affects the landing performance of the airplane. If the additional speed is not bled off by a landing screen height of 50 feet, the added speed is not accounted for in the calculation of runway landing distance required, and the added speed significantly increases the risk of a runway overrun.

Landing beyond the intended touchdown point can also have a similar effect. The aircraft flight manual landing performance data usually assumes a touchdown point determined through flight testing procedures, If the airplane does not touch down at the intended touchdown point or an allowance is not made for the longer touchdown point, it will not be possible to achieve the calculated landing distance.

Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A)

According to FAA-H-8083-25A, the majority of pilot-caused aircraft accidents occur during the takeoff and landing phase of flight. Because of this fact, the pilot must be familiar with all the variables that influence the takeoff and landing performance of an aircraft and must strive for exacting, professional procedures of operation during these phases of flight.

Takeoff and landing performance is a condition of accelerated and decelerated motion. For instance, during takeoff, an aircraft starts at zero speed and accelerates to the takeoff speed to become airborne. During landing, the aircraft touches down at the landing speed and decelerates to zero speed. The important factors of takeoff or landing performance are:

• The takeoff or landing speed is generally a function of the stall speed or minimum flying speed.

• The rate of acceleration/deceleration during the takeoff or landing roll. The speed (acceleration and deceleration) experienced by any object varies directly with the imbalance of force and inversely with the mass of the object. An airplane on the runway moving at 75 knots has four times the energy it has traveling at 37 knots. Thus, an airplane requires four times as much distance to stop as required at half the speed.

• The takeoff or landing roll distance is a function of both acceleration/deceleration and speed.

In many cases, the landing distance of an aircraft will define the runway requirements for flight operations. The minimum landing distance is obtained by landing at some minimum safe speed, which allows sufficient margin above stall and provides satisfactory control and capability for a go-around. Generally, the landing speed is some fixed percentage of the stall speed or minimum control speed for the aircraft in the landing configuration. As such, the landing will be accomplished at some particular value of lift coefficient and AOA. The exact values will depend on the aircraft characteristics but, once defined, the values are independent of weight, altitude, and wind.

To obtain minimum landing distance at the specified landing speed, the forces that act on the aircraft must provide maximum deceleration during the landing roll. The forces acting on the aircraft during the landing roll may require various procedures to maintain landing deceleration at the peak value.

A distinction should be made between the procedures for minimum landing distance and an ordinary landing roll with considerable excess runway available. Minimum landing distance will be obtained by creating a continuous peak deceleration of the aircraft; that is, extensive use of the brakes for maximum deceleration. On the other hand, an ordinary landing roll with considerable excess runway may allow extensive use of aerodynamic drag to minimize wear and tear on the tires and brakes. If aerodynamic drag is sufficient to cause deceleration, it can be used in deference to the brakes in the early stages of the landing roll; i.e., brakes and tires suffer from continuous hard use, but aircraft aerodynamic drag is free and does not wear out with use. The use of aerodynamic drag is applicable only for deceleration to 60 or 70 percent of the touchdown speed. At speeds less than 60 to 70 percent of the touchdown speed, aerodynamic drag is so slight as to be of little use, and braking must be utilized to produce continued deceleration. Since the objective during the landing roll is to decelerate, the powerplant thrust should be the smallest possible positive value (or largest possible negative value in the case of thrust reversers).

In addition to the important factors of proper procedures, many other variables affect the landing performance. Any item that alters the landing speed or deceleration rate during the landing roll will affect the landing distance.

The effect of gross weight on landing distance is one of the principal items determining the landing distance. One effect of an increased gross weight is that a greater speed will be required to support the aircraft at the landing AOA and lift coefficient. For an example of the effect of a change in gross weight, a 21 percent increase in landing weight will require a ten percent increase in landing speed to support the greater weight.

When minimum landing distances are considered, braking friction forces predominate during the landing roll and, for the majority of aircraft configurations, braking friction is the main source of deceleration.

The minimum landing distance will also vary in direct proportion to the gross weight. For example, a ten percent increase in gross weight at landing would cause a:

• Five percent increase in landing velocity
• Ten percent increase in landing distance

A contingency of this is the relationship between weight and braking friction force.

The effect of wind on landing distance is large and deserves proper consideration when predicting landing distance. Since the aircraft will land at a particular airspeed independent of the wind, the principal effect of wind on landing distance is the change in the groundspeed at which the aircraft touches down. The effect of wind on deceleration during the landing is identical to the effect on acceleration during the takeoff.

The effect of pressure altitude and ambient temperature is to define density altitude and its effect on landing performance. An increase in density altitude increases the landing speed but does not alter the net retarding force. Thus, the aircraft at altitude lands at the same IAS as at sea level but, because of the reduced density, the TAS is greater. Since the aircraft lands at altitude with the same weight and dynamic pressure, the drag and braking friction throughout the landing roll have the same values as at sea level. As long as the condition is within the capability of the brakes, the net retarding force is unchanged, and the deceleration is the same as with the landing at sea level. Since an increase in altitude does not alter deceleration, the effect of density altitude on landing distance is due to the greater TAS.

The approximate increase in landing distance with altitude is approximately three and one-half percent for each 1,000 feet of altitude. Proper accounting of density altitude is necessary to accurately predict landing distance.

The effect of proper landing speed is important when runway lengths and landing distances are critical. The landing speeds specified in the airplane flight manual (AFM) or pilot operating handbook (POH) is generally the minimum safe speeds at which the aircraft can be landed. Any attempt to land at below the specified speed may mean that the aircraft may stall, be difficult to control, or develop high rates of descent. On the other hand, an excessive speed at landing may improve the controllability slightly (especially in crosswinds), but causes an undesirable increase in landing distance.

A ten percent excess landing speed causes at least a 21 percent increase in landing distance. The excess speed places a greater working load on the brakes because of the additional kinetic energy to be dissipated. Also, the additional speed causes increased drag and lift in the normal ground attitude, and the increased lift reduces the normal force on the braking surfaces. The deceleration during this range of speed immediately after touchdown may suffer, and it is more probable for a tire to be blown out from braking at this point.

The most critical conditions of landing performance are combinations of high gross weight, high density altitude, and unfavorable wind. These conditions produce the greatest required landing distances and critical levels of energy dissipation required of the brakes. In all cases, it is necessary to make an accurate prediction of minimum landing distance to compare with the available runway. A polished, professional landing procedure is necessary because the landing phase of flight accounts for more pilot-caused aircraft accidents than any other single phase of flight.

In the prediction of minimum landing distance from the AFM/POH data, the following considerations must be given:

• Pressure altitude and temperature—to define the effect of density altitude
• Gross weight—which defines the CAS for landing.
• Wind—a large effect due to wind or wind component along the runway
• Runway slope and condition—relatively small correction for ordinary values of runway slope, but a significant effect of snow, ice, or soft ground

General Aviation Accident Prevention Handout "On Landings" (FAA-P-8740-48)

The FAA also advises in FAA-P-8740-48 that airspeed control is the most important factor in achieving landing precision. The secret of precise airspeed control begins in the traffic pattern with the stabilized approach and that pilot's can begin mastering airspeed control by checking "the numbers" in their AFM/POH and that they should know and use the appropriate airspeeds for each segment of their approach.

On short final with wings level, the airspeed should be at the recommended approach speed.

If the pilot carries too much airspeed at the moment of touchdown, their rollout distance ratio will increase by the square of the ratio of their actual touchdown speed over their normal touchdown speed.

For example, if an airplane that should be landed at 50 knots touches down at 55 knots (10 percent faster, or a factor of 1.1), the ground rollout distance will be increased by the square of this factor, or 1.21, if all other factors are constant. The distance used from touchdown to a full stop will then be 21 percent greater than for the minimum touchdown speed. This could be ample justification for a go-around.

Also if that approach was flown at 70 knots, or 20 knots faster than the normal approach speed, it would require 96 percent more rollout distance, or nearly double the runway for rollout alone.

Furthermore, the FAA also points out that at anytime, if the pilot happens to be carrying extra airspeed in the flare, the airplane will float, that is, glide from over the aim point, past the intended touchdown point, until that excess airspeed has dissipated.

Pilot Information

Certificate:	Private	**Age:**	46,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	June 29, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	September 1, 2009
Flight Time:	1700 hours (Total, all aircraft), 60 hours (Total, this make and model), 1650 hours (Pilot In Command, all aircraft), 100 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Aero Vodochody	**Registration:**	N111XN
Model/Series:	L39C	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	934873
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	July 1, 2010 Annual	**Certified Max Gross Wt.:**	11244 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo fan
Airframe Total Time:	460 Hrs as of last inspection	**Engine Manufacturer:**	Ivchenko
ELT:	Installed, not activated	**Engine Model/Series:**	A1-25TL
Registered Owner:	Air Vatche Inc.	**Rated Power:**	3850 Lbs thrust
Operator:	Air Vatche Inc.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	4N1,364 ft msl	**Distance from Accident Site:**	
Observation Time:	12:39 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.87 inches Hg	**Temperature/Dew Point:**	27°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Montgomery, NY (MGJ)	**Type of Flight Plan Filed:**	None
Destination:	West Milford, NJ (4N1)	**Type of Clearance:**	None
Departure Time:	12:20 Local	**Type of Airspace:**	

Airport Information

Airport:	Greenwood Lake Airport 4N1	**Runway Surface Type:**	Asphalt
Airport Elevation:		**Runway Surface Condition:**	Dry
Runway Used:	24	**IFR Approach:**	None
Runway Length/Width:	3471 ft / 60 ft	**VFR Approach/Landing:**	Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	41.128334,-74.346389(est)

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Robert Bromirski; FAA/ FSDO; Teterboro, NJ Bernd Rehn; Aero-Contact; Germany
Original Publish Date:	August 29, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81052