EJECTOR NOISE SUPPRESSION WITH AUXILIARY JET INJECTION pdf

1: Ejector Noise Suppression with Auxiliary Jet Injection - CORE

The goal for many jet noise suppression techniques is to increase the mixing between the jet and the ambient air or between the jet and a secondary fan stream so that the length of the high velocity region of the jet is reduced.

Lifting Properties[edit] Other key properties of an injector include the fluid inlet pressure requirements i. In a non-lifting injector, positive inlet fluid pressure is needed e. The steam-cone minimal orifice diameter is kept larger than the combining cone minimal diameter. It differs from the non-lifting type mainly in the relative dimensions of the nozzles. Check valve[edit] There is at least one check valve called a "clack valve" in locomotives because of the distinctive noise it makes [4] between the exit of the injector and the boiler to prevent back flow, and usually a valve to prevent air being sucked in at the overflow. Exhaust steam injector[edit] Efficiency was further improved by the development of a multi-stage injector which is powered not by live steam from the boiler but by exhaust steam from the cylinders, thereby making use of the residual energy in the exhaust steam which would otherwise have gone to waste. However, an exhaust injector also cannot work when the locomotive is stationary; later exhaust injectors could use a supply of live steam if no exhaust steam was available. Problems[edit] Injectors can be troublesome under certain running conditions, when vibration caused the combined steam and water jet to "knock off". Originally the injector had to be restarted by careful manipulation of the steam and water controls, and the distraction caused by a malfunctioning injector was largely responsible for the Ais Gill rail accident. Later injectors were designed to automatically restart on sensing the collapse in vacuum from the steam jet, for example with a spring-loaded delivery cone. Another common problem occurs when the incoming water is too warm and is less effective at condensing the steam in the combining cone. This can also occur if the metal body of the injector is too hot, e. Vacuum ejectors[edit] Diagram of a typical modern ejector An additional use for the injector technology is in vacuum ejectors in continuous train braking systems , which were made compulsory in the UK by the Regulation of Railways Act A vacuum ejector uses steam pressure to draw air out of the vacuum pipe and reservoirs of continuous train brake. Steam locomotives, with a ready source of steam, found ejector technology ideal with its rugged simplicity and lack of moving parts. A steam locomotive usually has two ejectors: The small ejector is sometimes replaced by a reciprocating pump driven from the crosshead because this is more economical of steam. Vacuum brakes have been superseded by air brakes in modern trains, which use pumps, as diesel and electric locomotives no longer have a suitable working fluid for vacuum ejectors. Earlier application of the principle[edit] Sketch of the smokebox of a steam locomotive, rotated 90 degrees. The similarity to the generic injector diagram at the top of this article is apparent. An empirical application of the principle was in widespread use on steam locomotives before its formal development as the injector, in the form of the arrangement of the blastpipe and chimney in the locomotive smokebox. The sketch on the right shows a cross section through a smokebox, rotated 90 degrees; it can be seen that the same components are present, albeit differently named, as in the generic diagram of an injector at the top of the article. Exhaust steam from the cylinders is directed through a nozzle on the end of the blastpipe, to reduce pressure inside the smokebox by entraining the flue gases from the boiler which are then ejected via the chimney. The effect is to increase the draught on the fire to a degree proportional to the rate of steam consumption, so that as more steam is used, more heat is generated from the fire and steam production is also increased. Modern uses[edit] The use of injectors or ejectors in various industrial applications has become quite common due to their relative simplicity and adaptability. To inject chemicals into the boiler drums of small, stationary, low pressure boilers. In large, high-pressure modern boilers, usage of injectors for chemical dosing is not possible due to their limited outlet pressures. In thermal power stations , they are used for the removal of the boiler bottom ash , the removal of fly ash from the hoppers of the electrostatic precipitators used to remove that ash from the boiler flue gas , and for drawing a vacuum pressure in steam turbine exhaust condensers. Jet pumps have been used in boiling water nuclear reactors to circulate the coolant fluid. For the bulk handling of grains or other granular or powdered materials. The construction industry uses them for pumping turbid water and slurries. Eductors are used in ships to pump residual ballast water, or cargo oil which cannot be removed using centrifugal pumps due to loss of suction head and may damage the centrifugal pump if run dry, which may be caused due to trim or list of the ship. Eductors are used on-board ships to pump out bilges, since using centrifugal pump would not be feasible as the suction head may be lost frequently. Some aircraft mostly earlier designs use an ejector attached to the fuselage to provide vacuum for gyroscopic instruments such as an attitude indicator artificial horizon. Eductors are used in aircraft fuel systems as transfer pumps; fluid flow from an engine-mounted mechanical pump can be delivered to a fuel tank-mounted eductor to transfer fuel from that tank. Aspirators are vacuum pumps based on the same operating principle and are used in laboratories to create a partial vacuum and for medical use in suction of mucus or bodily fluids. To create vacuum system in vacuum distillation unit oil refinery Main article: Water well pump Jet pumps are commonly used to extract water from water wells. The main pump, often a centrifugal pump , is powered and installed at ground level. Its discharge is split, with the greater part of the flow leaving the system, while a portion of the flow is returned to the jet pump installed below ground in the well. This recirculated part of the pumped fluid is used to power the jet. At the jet pump, the high-energy, low-mass returned flow drives more fluid from the well, becoming a low-energy, high-mass flow which is then piped to the inlet of the main pump. The S type pump is useful for removing water from a well or container. Shallow well pumps are those in which the jet assembly is attached directly to the main pump and are limited to a depth of approximately m to prevent cavitation. Deep well pumps are those in which the jet is located at the bottom of the well. The maximum depth for deep well pumps is determined by the inside diameter of and the velocity through the jet. The major advantage of jet pumps for deep well installations is the ability to situate all mechanical parts e. The advent of the electrical submersible pump has partly replaced the need for jet type well pumps, except for driven point wells or surface water intakes. Multi-stage steam vacuum ejectors[edit] In practice, for suction pressure below mbar absolute, more than one ejector is used, usually with condensers between the ejector stages. Condensing of motive steam greatly improves ejector set efficiency; both barometric and shell-and-tube surface condensers are used. In operation a two-stage system consists of a primary high-vacuum HV ejector and a secondary low-vacuum LV ejector. Initially the LV ejector is operated to pull vacuum down from the starting pressure to an intermediate pressure. Once this pressure is reached, the HV ejector is then operated in conjunction with the LV ejector to finally pull vacuum to the required pressure. In operation a three-stage system consists of a primary booster, a secondary high-vacuum HV ejector, and a tertiary low-vacuum LV ejector. As per the two-stage system, initially the LV ejector is operated to pull vacuum down from the starting pressure to an intermediate pressure. Once this pressure is reached, the HV ejector is then operated in conjunction with the LV ejector to pull vacuum to the lower intermediate pressure.

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2: :: Venturi Air Mover and Venturi Scrubber Manufacturers and Suppliers in India, Chennai

An experimental program to reduce aircraft jet turbulence noise investigated the interaction of small auxiliary jets with a larger main jet. Significant reductions in the far field jet noise were.

A bungee -assisted escape from an aircraft took place in In Everard Calthrop , an early inventor of parachutes , patented an ejector seat using compressed air. Dragomir patented his "catapult-able cockpit" at the French Patent Office. Prior to this, the only means of escape from an incapacitated aircraft was to jump clear "bail out" , and in many cases this was difficult due to injury, the difficulty of egress from a confined space, g forces , the airflow past the aircraft, and other factors. Early models were powered by compressed air and the first aircraft to be fitted with such a system was the Heinkel He prototype jet-engined fighter in One of the He test pilots, Helmut Schenk, became the first person to escape from a stricken aircraft with an ejection seat on 13 January after his control surfaces iced up and became inoperative. The fighter, being used in tests of the Argus As impulse jets for Fieseler Fi missile development, had its usual HeS 8A turbojets removed, and was towed aloft from the Erprobungsstelle Rechlin central test facility of the Luftwaffe in Germany by a pair of Bf C tugs in a heavy snow-shower. To save pilots a spring-driven catapult seat was developed in a few months time, but the prototype has been destroyed in during an air raid, shortly before its maiden flight. No one other prototype was finished before the fall of Budapest. A gunpowder ejection seat was developed by Bofors and tested in for the Saab The first test in the air was on a Saab 17 on 27 February , [4] and the first real use occurred by Lt. Bengt Johansson [note 2] on 29 July after a mid-air collision between a J 21 and a J In this system, the seat rode on wheels set between two pipes running up the back of the cockpit. When lowered into position, caps at the top of the seat fitted over the pipes to close them. Cartridges, basically identical to shotgun shells, were placed in the bottom of the pipes, facing upward. When fired, the gases would fill the pipes, "popping" the caps off the end, and thereby forcing the seat to ride up the pipes on its wheels and out of the aircraft. By the end of the war, the Dornier Do Pfeil â€” primarily from it having a rear-mounted engine of the twin engines powering the design powering a pusher propeller located at the aft end of the fuselage presenting a hazard to a normal "bailout" escape â€” and a few late-war prototype aircraft were also fitted with ejection seats. After World War II, the need for such systems became pressing, as aircraft speeds were getting ever higher, and it was not long before the sound barrier was broken. Manual escape at such speeds would be impossible. The United States Army Air Forces experimented with downward-ejecting systems operated by a spring , but it was the work of James Martin and his company Martin-Baker that proved crucial. Shortly afterward, on 17 August , 1st Sgt. Larry Lambert was the first live U. Lynch demonstrated the ejection seat at the Daily Express Air Pageant in , ejecting from a Meteor. Early seats used a solid propellant charge to eject the pilot and seat by igniting the charge inside a telescoping tube attached to the seat. As aircraft speeds increased still further, this method proved inadequate to get the pilot sufficiently clear of the airframe. In , the Convair F Delta Dagger was the first aircraft to be fitted with a rocket-propelled seat. Martin-Baker developed a similar design, using multiple rocket units feeding a single nozzle. The greater thrust from this configuration had the advantage of being able to eject the pilot to a safe height even if the aircraft was on or very near the ground. In the early s, deployment of rocket-powered ejection seats designed for use at supersonic speeds began in such planes as the Convair F Delta Dart. Following an accident on 30 July in the attempted launch of a D drone , two Lockheed M [7] crew members ejected at Mach 3. The pilot was recovered successfully, but the launch control officer drowned after a water landing. Despite these records, most ejections occur at fairly low speeds and altitudes, when the pilot can see that there is no hope of regaining aircraft control before impact with the ground. Late in the Vietnam War, the U. Air Force and U. Navy became concerned about its pilots ejecting over hostile territory and those pilots either being captured or killed and the losses in men and aircraft in attempts to rescue them. Three companies submitted papers for further development: A Rogallo wing design by Bell Systems; a gyrocopter design by Kaman Aircraft ; and a mini-conventional fixed wing aircraft employing a Princeton Wing i. All three, after ejection, would be propelled by small turbojet engine developed for target drones. With the exception of the Kaman design, the pilot would still be required to parachute to the ground after reaching a safety-point for rescue. It came close to being tested with a special landing-gear platform attached to the AERCAB ejection seat for first-stage ground take offs and landings with a test pilot. The pilot was recovered by helicopter. The pilot typically experiences an acceleration of about 12â€"14 g. Compression fractures of vertebrae are a recurrent side effect of ejection. It was theorised early on that ejection at supersonic speeds would be unsurvivable; extensive tests, including Project Whoosh with chimpanzee test subjects, were undertaken to determine that it was feasible. Documented evidence exists that pilots of the US [14] and Indian navies have performed this feat. Early models of the ejection seat were equipped with only an overhead ejection handle which doubled in function by forcing the pilot to assume the right posture and by having him pull a screen down to protect both his face and oxygen mask from the subsequent air blast. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. May Learn how and when to remove this template message A warning applied on the cockpit side of some aircraft using an ejection seat system intended especially for the maintenance and emergency crews The "standard" ejection system operates in two stages. First, the entire canopy or hatch above the aviator is opened, shattered, or jettisoned, and the seat and occupant are launched through the opening. In most earlier aircraft this required two separate actions by the aviator, while later egress system designs, such as the Advanced Concept Ejection Seat model 2 ACES II , perform both functions as a single action. Stricklin was not injured. The A uses connected firing handles that activate both the canopy jettison systems, followed by the seat ejection. The F has the same connected system as the A seat. Both handles accomplish the same task, so pulling either one suffices. Early models of the F Starfighter were equipped with a Downward Track ejection seat due to the hazard of the T-tail. In order to make this work, the pilot was equipped with "spurs" which were attached to cables that would pull the legs inward so the pilot could be ejected. Following this development, some other egress systems began using leg retractors as a way to prevent injuries to flailing legs, and to provide a more stable center of gravity. Some models of the F were equipped with upward-ejecting seats. Similarly, two of the six ejection seats on the B Stratofortress fire downward, through hatch openings on the bottom of the aircraft; the downward hatches are released from the aircraft by a thruster that unlocks the hatch, while gravity and wind remove the hatch and arm the seat. The four seats on the forward upper deck two of them, EWO and Gunner, facing the rear of the airplane fire upwards as usual. Any such downward-firing system is of no use on or near the ground if aircraft is in level flight at the time of the ejection. Aircraft designed for low-level use sometimes have ejection seats which fire through the canopy, as waiting for the canopy to be ejected is too slow. Many aircraft types e. The MDC is initiated when the eject handle is pulled, and shatters the canopy over the seat a few milliseconds before the seat is launched. This system was developed for the Hawker Siddeley Harrier family of VTOL aircraft as ejection may be necessary while the aircraft was in the hover, and jettisoning the canopy might result in the pilot and seat striking it. The A Thunderbolt II is equipped with canopy breakers on either side of its headrest in the event that the canopy fails to jettison. The T-6 is also equipped with such breakers if the MDC fails to detonate. In ground emergencies, a ground crewman or pilot can use a breaker knife attached to the inside of the canopy to shatter the transparency. The A-6 Intruder and EA-6B Prowler seats were capable of ejecting through the canopy, with canopy jettison a separate option if there is enough time. CD and TCP systems cannot be used with canopies made of flexible materials, such as the Lexan polycarbonate canopy used on the F Soviet VTOL naval fighter planes such as the Yakovlev Yak were equipped with ejection seats which were automatically activated during at least some part of the flight envelope. Halfway between simply "bailing out" and using explosive-eject systems, Drag Extraction uses the airflow past the aircraft or spacecraft to move the aviator out of the cockpit and away from the stricken craft on a guide rail. Some operate like a standard ejector seat, by jettisoning the canopy, then deploying a drag chute into the airflow. That chute pulls the occupant out of the aircraft, either with the seat or following release of the seat straps, who then rides off the end of a rail extending far enough out to help clear the structure. In the case of the Space Shuttle, the astronauts would have ridden a long, curved rail, blown by the wind against their bodies, then deployed their chutes after free-falling to a safe altitude. Crewmember escape capsule from a B Hustler Encapsulated Seat egress systems were developed for use in the B Hustler and B Valkyrie supersonic bombers. These seats were enclosed in an air-operated clamshell, which permitted the aircrew to escape at airspeeds and altitudes high enough to otherwise cause bodily harm. These seats were designed to allow the pilot to control the plane even with the clamshell closed, and the capsule would float in case of water landings. Some aircraft designs, such as the General Dynamics F , do not have individual ejection seats, but instead, the entire section of the airframe containing the crew can be ejected as a single capsule. In this system, very powerful rockets are used, and multiple large parachutes are used to bring the capsule down, in a manner similar to the Launch Escape System of the Apollo spacecraft. On landing, an airbag system is used to cushion the landing, and this also acts as a flotation device if the Crew Capsule lands in water. Zero-zero ejection seat[edit] K DM Ejection seat used on MiG A zero-zero ejection seat is designed to safely extract upward and land its occupant from a grounded stationary position i. Parachutes require a minimum altitude for opening, to give time for deceleration to a safe landing speed. Thus, prior to the introduction of zero-zero capability, ejections could only be performed above minimum altitudes and airspeeds. If the seat was to work from zero aircraft altitude, the seat would have to lift itself to a sufficient altitude. These early seats fired the seat from the aircraft with a cannon, providing the high impulse needed over the very short length on the cannon barrel within the seat. This limited the total energy, and thus the additional height possible, as otherwise the high forces needed would crush the pilot. Zero-zero technology uses small rockets to propel the seat upward to an adequate altitude and a small explosive charge to open the parachute canopy quickly for a successful parachute descent, so that proper deployment of the parachute no longer relies on airspeed and altitude. The seat cannon clears the seat from the aircraft, then the under-seat rocket pack fires to lift the seat to altitude. As the rockets fire for longer than the cannon, they do not require the same high forces. Zero-zero rocket seats also reduced forces on the pilot during any ejection, reducing injuries and spinal compression. Other aircraft[edit] The Kamov Ka , which entered limited service with Russian forces in , was the first production helicopter with an ejection seat. The system is similar to that of a conventional fixed-wing aircraft however the main rotors are equipped with explosive bolts to jettison the blades moments before the seat is fired. The Soviet shuttle " Buran " was planned to be fitted with KRB KMF35 seats, but it was unmanned on its single flight; the seats were never installed. The only commercial jetliner ever fitted with ejection seats was the Soviet Tupolev Tu However, the seats were present in the prototype only, and were only available for the crew and not the passengers. The Tu that crashed at the Paris Air Show in was a production model, and did not have ejection seats. The only spacecraft ever flown with installed ejection seats were the Space Shuttle , the Soviet Vostok and American Gemini series.

3: PET Preform Injection Molding Machine - Powerjet Machinery

A variety of auxiliary jet and ejector configurations and operating conditions were studied. The best conditions tested produced peak to peak noise reductions ranging from 11 to 16 dB, depending on measurement angle, for auxiliary jet mass flows that were % of the main jet flow with ejectors that were 8 times the main jet diameter in length.

Specially PET screw highly increases the plasticinzing speed and shot weight, lowers the plasticizing speed and show weight, lower the plasticizing temperature and AAvalue, also lower the shearing of preform while achieves better transparency. Total 23 models for different shot weight and for deep cavity products. PET shot weight from grams to grams for choice. Can choose the right machine according to exactly requirment and waste no more energy. Increased ejector force and stroke: Push out preforms more fast and accurate. Hot runner system interface: Professional design for PET preform molds and no more raw materials waste. Fast and efficient Fast Computer: Techmation controling system, which is easy for operation with strong expandability and can realize real-time synchronization control of machine and robot running. Accumulator with servo valve is adopted to control the injection, which makes the accurate shot;The synchronous plasticizing and injection ensures the application of big injection volume and shorten the circle time. Unique accumulator with servo valve for ejector and opening-closing mod hydraulic control system ensures the ejection and opening-closing mold movement stable, fast and accurate. This can protect the mold efficiently and match the requirement of take-out robot. Special designed high performance robot for preform takingâ€”out is equipped with German SEW servo systerm, ensures the movement fast and stable, can provide 3 time cycle cooling outside the mold. The equipped ice water cooling system ensures the preform to be cooling down without stress. Efficiency Hydraulic Circuit System: Accumulator with servo valve is adopted to control the injection accurately; Two-circuit hydraulic designs makes high speed and high efficiency, synchroniztion on plasticizing and opening-closing the mold to shorten the production cycle. Synchronization pressure holding and plasticizing: Reliable Branded controling system is adopted for injection, recovery, plasticization, mould clamping and ejection. Closed-loop servo valves enables the machine to react fast and precisely to the PLC signals. Branded servo driving systems ensure fast and accurate moving of the robot plate. Energy Saving Multiple differential circuits mechanism is used for hydraulic control of the machine, which reduces lost energy Servo motro or variable pump is optional. PET shot weight from grams to grams machines to shoose for exactly requirments and waste no more energy.

EJECTOR NOISE SUPPRESSION WITH AUXILIARY JET INJECTION pdf

4: Injector - Wikipedia

The best conditions tested produced peak to peak noise reductions ranging from 11 to 16 dB, depending on measurement angle, for auxiliary jet mass flows that were % of the main jet flow with ejectors that were 8 times the main jet diameter in length.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows: An exhaust nozzle for suppressing engine noise of a moderately high bypass ratio aircraft turbofan engine, the nozzle comprising: The exhaust nozzle according to claim 1, wherein the centerbody is a translatable centerbody including a plug and an assembly located axially within the plug for translating the plug in a fore and aft direction. The exhaust nozzle according to claim 1, wherein the nozzle is a circular nozzle and the ejector is an annular ejector having portions extending through the sidewalls circumferentially about the nozzle. The exhaust nozzle according to claim 3, wherein the ejector includes an exterior air inlet passage extending through the sidewalls and outer and inner doors for closing off the passage to the exterior atmosphere and the exhaust duct, respectively. The exhaust nozzle according to claim 1, further comprising mixing components associated with the ejector for encouraging mixing of the entrained exterior air with the engine exhaust. The aircraft exhaust nozzle according to claim 7, wherein the plurality of turning vanes are positioned within the passage in a fore-to-aft direction to impart an angle of about 20 to 50 degrees of swirl to the entering exterior air, the turning vanes thereby imparting a tangential directional component to the entering exterior air. An aircraft engine exhaust nozzle for suppressing engine noise, the nozzle comprising: The exhaust nozzle according to claim 9, wherein the nozzle is a circular nozzle and the ejector is an annular ejector. The aircraft exhaust nozzle according to claim 9, wherein the plurality of turning vanes are positioned within the passage in a fore-to-aft direction to impart an angle of about 20 to 50 degrees of swirl to the entering exterior air, the turning vanes thereby imparting a tangential directional component to the entering exterior air. The exhaust nozzle according to claim 9, wherein the passage is oriented at an inward angle between about 20 to 45 degrees in going in the fore-to-aft direction. The exhaust nozzle according to claim 9, wherein the passage and the mixing components are located in a divergent region of the exhaust duct. The exhaust nozzle according to claim 9, wherein the turning vanes are stationary. The exhaust nozzle according to claim 9, wherein the plurality of turning vanes includes 24 to 84 turning vanes. The exhaust nozzle according to claim 9, further comprising a control system having at least one input indicative of current flight conditions, the control system being in communication with the ejectors to cause the ejectors to assume their open position during at least one of takeoff and landing approach. The noise is influenced by the shearing action caused by the relative speed and temperature between the ambient and exhaust airflows. Jet exhaust noise may be reduced if the relative temperature and velocity is reduced. Exhaust noise can be especially troublesome for supersonic airplanes because current designs employ turbojets or low bypass ratio turbofans which require high velocity exhaust to produce the required thrust during takeoff. Ejector nozzles are currently used extensively in pure jet and low bypass ratio engines as noise suppression devices. Generally, ambient air is introduced i. The ambient air is mixed with the hot engine exhaust, thereby reducing the overall velocity and temperature of the engine exhaust before it exits the nozzle. Mixing components are occasionally used in conjunction with the ejectors in the pure jet and low bypass ratio applications in order to more thoroughly mix ambient air with exhaust gas. Turbojet and low bypass ratio engines require high aspiration levels i. High aspiration levels require the ability to significantly vary nozzle geometry. This requires ejectors capable of assuming a wide range of positions. In addition, the ejectors and mixing components must be capable of being selectively removed from the nozzle duct airflow path in order to transition the nozzle to an acceptable performance configuration when noise suppression is not required. The combination of these requirements often results in nozzle designs that are heavy, complex, and have low performance characteristics. In contrast to the pure jet and low bypass ratio engines, moderately high bypass ratio engines i. Noise reduction for moderately high bypass ratio engines generally consists of using a common or integrated exhaust nozzle that partially mixes the bypass and primary exhaust gases prior to their ejection into the atmosphere. It is known to use ejector nozzles to improve nozzle performance in specific flight conditions. In particular, adding ambient air around the periphery of the exhaust gases of a bypass engine reduces aerodynamic boattail drag at transonic conditions. This is done during transonic and supersonic flight conditions where noise suppression is of no concern. For low bypass ratio applications, it is also known to use ejector nozzles to reduce noise. This is not the case for moderately high bypass ratio applications. Where the aerodynamic performance benefit is not sought, such as during takeoff and landing approach, ambient air is not added in a moderately high bypass ratio engine. Ejectors for mixing ambient with engine exhaust have not been used in moderately high bypass ratio turbofan engines for noise reduction for various reasons, including the generally held belief that the benefits of such use would be too small to justify the weight, space, and system complexity expenses associated with adding low bypass ratio ambient air noise suppression ejectors to moderately high bypass ratio jet engines. In contrast to this belief, the inventors have recently discovered, however, that an optimum noise suppression solution for some aircraft is to aspirate a relatively small amount of ambient air into the engine exhaust of moderately high bypass ratio turbofan engines powering the aircraft. This has resulted in a need for such a nozzle. The ideal nozzle should not significantly add weight, space, or complexity to the overall engine system. The noise suppression nozzle is a termed a low aspiration ejector nozzle. In a preferred embodiment, the nozzle includes an outer structure within which a centerbody is longitudinally located. The exhaust nozzle may be either a two-dimensional or axisymmetric nozzle. The area between the centerbody and the outer structure generally defines a convergent-divergent exhaust duct. An ejector extends through the outer structure at a location near the duct throat. Mixing components may be provided to further enhance mixing of engine exhaust and exterior air. Both the ejector and the mixing components are located near the throat or near the divergent region of the exhaust duct. In accordance with further aspects of this invention, one embodiment of the centerbody includes a plug and lead ball assembly located axially within the plug for translating the plug in a fore and aft direction. In accordance with other aspects of this invention, one embodiment of the ejector includes an inlet passage extending through the outer structure. The passage is oriented at an inward angle between about 20 to 45 degrees in going in the fore-to-aft direction. Inner and outer doors are provided for closing off the passage to the exterior atmosphere and the exhaust duct, respectively. The ejector includes an open position and a close position. In accordance with still further aspects of this invention, preferred mixing components include a plurality of stationary turning vanes located within the ejector inlet passage. The turning vanes are positioned within the passage in a fore-to-aft direction to impart an angle of about 20 to 50 degrees to the entering exterior air. The turning vanes thereby impart a tangential directional component i. The plurality of turning vanes preferably includes about 24 to 84 turning vanes. In accordance with still other aspects of this invention, the ejector nozzle further includes a control system having at least one input indicative of current flight conditions. In accordance with yet other aspects of this invention, a method of suppressing aircraft moderately high bypass ratio turbofan engine exhaust noise is provided. The method includes providing an engine of moderately high bypass ratio of preferably between about 0. The method may additionally include the step of mixing the entrained exterior air and the engine exhaust in the exhaust duct. A preferred embodiment of the method of mixing includes using the turning vanes. In accordance with yet further aspects of this invention, the exterior air is ambient air and the engine exhaust is a combination of primary exhaust and bypass airflow. As used herein, the term "exterior air" generally refers to ambient air. Exterior air may, however, refer to bypass air or to a mixture of bypass and ambient, depending on the application. The term "engine exhaust" generally refers to a combination of primary and bypass air. Likewise, engine exhaust may refer to pure primary exhaust, depending on the application. The term "nozzle exhaust" refers to the combination of the exterior air and engine exhaust. A nozzle formed in accordance with the present invention is described below as applied to an axisymmetric nozzle. With appropriate changes, the present invention, however, may be designed for use with a two-dimensional nozzle. A series of turbines 18 are located near the aft end of the generator and are mounted to a turbine shaft In some turbofan engine designs, a tail cone 22 extends aftward through the interior of the annulus to form a short primary duct 24 between the annulus and the cone. The turbines expel primary exhaust rearward out the primary duct. A large single or multi-stage fan 26 supplies a secondary or by-pass airstream that flows through a fan duct 28 circumscribing a forward portion of the gas generator. The fan is co-axially mounted to the turbine shaft. To reduce exhaust noise for high and moderately high bypass ratio engines, a common exhaust nozzle not shown may extend aftward from the fan to form a duct region in which the secondary and primary airflows merge prior to being expelled jointly into the atmosphere. The subsonic mixing of these airflows occurs just aft of the annulus, at a confluence plane In general, the nozzle 36 includes a number of ejectors 38 placed equal distances about the circumference of the nozzle. The exterior air 40 is mixed with the engine exhaust 42, resulting in a lower combined airflow velocity which in turn reduces jet exhaust noise. During the cruise portion of a flight, the nozzle 36 may utilize the ejectors 38 to maximize flight performance by reducing aft body drag. Preferably, mixing components one embodiment shown in FIG. In more detail, the nozzle 36 includes an outer structure 46 attached to the aft end of the gas generator. As is known in the general art of nozzle design, the outer structure 46 includes numerous support beams and struts not shown positioned longitudinally and circumferentially or laterally at various locations throughout the nozzle The support beams and struts support the weight of the nozzle components and react to nozzle pressure and maneuver loads during flight. The present invention uses such support beams and struts to carry the ejectors 38 and mixing components as well. Outer skins attached to the outboard regions of the support beams and struts form the nozzle exterior surface Inner skins attached to the inboard regions of the support beams and strut form nozzle interior surfaces or nozzle sidewalls The support beams and struts and the skins are provided and appropriately modified to accommodate the features of the present invention as described herein. The area between the centerbody exterior surface 54 and the nozzle sidewalls 50 defines an exhaust duct The centerbody 52 is shaped so as to alter the exhaust duct 56 contour in order to influence engine thrust and performance characteristics. Since centerbodies are known in the art of nozzle design they are described here only in general terms. The centerbody 52 may be a stationary or movable exhaust tail cone, plug assembly, or other component positioned longitudinally in the nozzle duct The plug 58 is shaped to ensure a convergent-divergent nozzle exhaust duct shape. Fore and aft translation of the plug 58 varies the size and location of the duct throat The duct throat 59 is defined as the region where the nozzle exhaust duct changes from divergent to convergent. Changing the location of the duct throat 59 allows the nozzle 36 to be precisely matched to an engine as engine settings and conditions change. As is seen by comparing FIGS. Longitudinal centerbody translation may be accomplished using any one of a number of methods. One example of a translatable arrangement is shown in FIGS. The nozzle tail cone includes a concentric cylinder 63 that extends aftward into the plug 58, ending at approximately the end of the nozzle. A power screw 62 is located within the concentric cylinder and is oriented along the nozzle longitudinal center line.

5: Ejection seat - Wikipedia

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Gas or liquid from 1st or 2nd stage separator Injection or lift gas Advantages of ejectors compared with mechanical compressors: No moving parts, hence low maintenance requirement No running costs â€" ejectors can use HP gas energy traditionally wasted across a choke valve or HP recycle gas from an existing compressor Relatively low costs mean project upgrades using ejectors become cost-effective Environmentally friendly option Fast-track installation makes short-term well opportunities viable Minimal disruption to existing production operations Low weight and compact size allow installation on most production facilities Performance can be easily modified to suit depleting well conditions Ejectors are suitable for both topside and subsea installation Safe, reliable operation Easy to control using standard techniques Accidental entrainment of liquid slugs may cause momentary interruption in pumping, but no damage to equipment. Low noise Industry case studies The case study described below provides an overview of the kind of issues that may occur during ejector implementation. The project consisted of evaluating the benefits of installing an ejector, with Well 5 as motive fluid, and Well 1 and Well 3 as entrained fluid. The justifications for an ejector rather than a booster compressor in this particular case were: The platform has no power to run an electrical compressor. It is unmanned so rotating machines are avoided. A gas-engine driven compressor would have been detrimental to the environment and incur the additional costs of gas consumption. The ejector is a small device with no moving parts. The ejector is driven by an existing force Well 5. Costs were driven by piping works offshore and associated production losses. One major expectation was the frequent change out of the ejector internals to cope with the decline of the production. Important remark The expected behaviour of each of the wells in question was difficult to forecast because: Well 5 was newly developed with no historical data. Well 1 stopped producing after four years due to a water cross-flow from the bottom reservoir to the top reservoir that took some time to shut off. Well 3 was killed by too much formation water production after 3 years. Illustration of industrial example of ejector use Implementation of the ejector The efficiency of an ejector increases with the differential between motive fluid and entrained fluid in terms of flow rate and pressure. For this reason the project had to be implemented quickly in anticipation of the decline of Well 5. The project was performed within eight months. Additional dynamic information from Well 5 was gained. A redesign of the ejector was performed with the additional constraint of respecting the initial spacial footprint which was already fixed. Results The ejector was effective in reducing the wellhead pressures of Well 1 and Well 3 as planned but, unfortunately, the 20 bars reduction was insufficient to restart either of the two wells. The ejector was a technical success but the candidate wells did not respond as expected. Well 1 was dewatered by means of nitrogen injection, after which it was opened with the ejector and restarted. After six months, the output was three times higher and production has been stable with the well operating on its own. Subsequently, the ejector was connected to another well on the platform â€" Well 4 â€" where it was used successfully to stabilize and increase production. Thanks to the ejector, this previously dead well was restarted successfully. For Well 1, the costs of the ejector installation and the nitrogen lifting operation were paid back between six months and one year after production was restarted. The internals of the ejector are changeable and the main part can be reused in a future project after the decline of Well 5. Due to the success of this ejector, it has become established as a technology that is investigated systematically for each new project.

EJECTOR NOISE SUPPRESSION WITH AUXILIARY JET INJECTION pdf

6: Engine noise suppression ejector nozzle - The Boeing Company

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Noise is generated from the shearing action between the surrounding atmosphere and air jets from orifices. The combustion system of a gas turbine generates hot gases to drive a turbine. The turbine, in turn, drives a compressor that provides compressed air for combustion in the combustion system. The turbine produces usable output power. In some gas turbine applications, there are instances of gas turbine plant operation where the gas turbine pressure ratio reaches the operating pressure ratio limit of the compressor, resulting in compressor surge. The compressor pressure ratio is typically larger than the turbine pressure ratio in that the latter is subject to pressure loss in the turbine combustor. One common solution that has been used to provide compressor pressure ratio protection is the bleeding off of gas turbine compressor discharge air and recirculating the bleed air back to the compressor inlet. This method of gas turbine operation, known as Inlet Bleed Heat IBH Control, raises the inlet temperature of the compressor inlet air by mixing the colder ambient air with the bleed portion of the hot compressor discharge air, thereby reducing the air density and the mass flow to the gas turbine. When a gas turbine bleeds compressor air into the inlet duct, it creates noise that can exceed noise limits. Existing designs place the bleeding manifolds downstream of inlet silencing panels. This arrangement can address an icing problem of the compressor IGV, but does not sufficiently solve the problem of inlet filter housing icing. If the bleeding manifolds are placed before the silencers in the inlet duct to address the icing problem, the noise problem arises. A silencing nozzle was proposed for an IBH system. Silencing nozzles, however, are expensive. The noise results from shearing action between the surrounding atmosphere and air jets from orifices. There is currently no similar technology to reduce noise in a gas turbine. A plurality of acoustic dispersion nozzles are disposed at an output end of the inlet bleed heat manifold and between the inlet filter housing and the inlet silencer. The acoustic dispersion nozzles serve to reduce a velocity of the compressor discharge air in the inlet bleed heat manifold by mixing the compressor discharge air with outside air from the inlet filter housing. In another exemplary embodiment, an inlet bleed heat system in a gas turbine includes a compressor discharge extraction manifold that extracts compressor discharge air, an inlet bleed heat manifold receiving the compressor discharge air, and a plurality of acoustic dispersion nozzles disposed at an output end of the inlet bleed heat manifold that reduce a velocity of the compressor discharge air in the inlet bleed heat manifold. In yet another exemplary embodiment, a method for reducing noise in an inlet bleed heat system of a gas turbine includes the steps of extracting compressor discharge air; directing the compressor discharge air into an inlet bleed heat manifold; and reducing a velocity of the compressor discharge air in the inlet bleed heat manifold by mixing the compressor discharge air with outside air via an inlet filter housing. Inlet bleed heat IBH is typically used to protect the gas turbine compressor from icing when operating at reduced IGV angles. Moreover, IBH systems are used to reduce compressor pressure ratio at certain operating conditions where additional compressor operating margin is required. As illustrated, a compressor discharge extraction manifold 12 is provided for extracting compressor discharge air, which flows through a manual isolation valve 14 and a control valve 16 to an inlet bleed heat manifold 18 disposed downstream of an inlet air filter housing 20 and an inlet silencer In the illustrated system, a drain valve 24 is provided for diverting condensate. An output end of the inlet bleed heat manifold 18 includes a plurality of acoustic dispersion nozzles The nozzles 26 serve to reduce a velocity of the compressor discharge air in the inlet bleed heat manifold 18 by mixing the compressor discharge air with outside air from the inlet filter housing With reference to FIGS. The acoustic dispersion nozzles 26 are disposed on the branch manifolds Those of ordinary skill in the art will appreciate alternative suitable designs for the nozzle 26, and the invention is not meant to be limited to the exemplary nozzle illustrated in FIG. While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. An inlet bleed heat system in a gas turbine comprising: An inlet bleed heat system according to claim 1 , wherein the inlet bleed heat manifold comprises a main manifold and a plurality of branch manifolds connected to the main manifold, and wherein the plurality of acoustic dispersion nozzles are disposed on the branch manifolds. An inlet bleed heat system according to claim 4 , wherein the inlet bleed heat manifold comprises a main manifold and a plurality of branch manifolds connected to the main manifold, and wherein the plurality of acoustic dispersion nozzles are disposed on the branch manifolds. A method for reducing noise in an inlet bleed heat system of a gas turbine, the method comprising: A method according to claim 7 , wherein the inlet bleed heat manifold comprises a main manifold and a plurality of branch manifolds connected to the main manifold, and wherein the method comprises disposing the acoustic dispersion nozzles on the branch manifolds.

7: CAC - Jet engine noise suppression system - Google Patents

Significant reductions in the far field jet noise were obtained over a range of auxiliary jet pressures and flow rates when used in conjunction with an acoustically lined ejector.

8: Ejectors | IPIECA

In order to maintain the desired pressure on the low-pressure side of the gas ejector, some standard control techniques are available including the following: Recycling of gas from the discharge side of the gas ejector back into the low pressure side.

9: Transvac | Oil & Gas Ejector Solutions | Flare Gas Recovery

The invention relates to noise reduction in a gas turbine and, more particularly, to the use of a multiple stage ejector/mixer nozzle in a gas turbine inlet bleed heat application to reduce noise. The combustion system of a gas turbine generates hot gases to drive a turbine.

EJECTOR NOISE SUPPRESSION WITH AUXILIARY JET INJECTION pdf

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