MASSACHUSETTS AIR AND SPACE MUSEUM

HORIZONS

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A NEW Generation of Supersonics Is Coming!

The world was a much smaller place when two commercial jet aircraft flew faster than the speed of sound. The joint Franco-British venture that produced the ***Concorde***, and the Russian-built ***Tupolev Tu-144*** reached speeds of Mach 2.04 and Mach 1.6, respectively. These commercial flyers could get to and from places in less than half the time as conventional aircraft. Despite the disaster that befell *Concorde* on ill-fated Air France Flight 4590 which crashed immediately after take off, the real demise of supersonic commercial travel was the cost. The price of fuel added to the cost of crews had risen since the inception of the supersonic transport *(SST)* era some 27

The *Spike Aerospace* S-512

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Mike Goulian

Accomplished Aerobatic Pilot Joins MASM Board of Directors

He was born into an aviation business family, which founded Executive Flyers Aviation, one of the largest flying schools in the Northeastern United States in 1964. Michael's father, Myron Goulian (also known as "Mike"), was an FAA examiner. Michael grew up by washing airplanes and sweeping the hangar floor. He learned to fly before he could even drive a car and soloed a Cessna 150 on his 16th birthday in 1984.

Mike Goulian began his aerobatic training in 1985 during his pilot study. He then established an aerobatic school within Executive Flyers Aviation. While earning his living as a corporate airline pilot, he worked his way toward the top ranks of air show display flying and competition aerobatics where he became United States National Champion in the Advanced Category at the age of 22; making him the youngest pilot ever to have won that competition.

In 1992, he was the top-ranked US male aerobatic pilot and Silver Medalist in the Unlimited Category; an achievement he repeated in 1993. In 1995, he became the US National Champion in the Unlimited Category. He was a member of the US Aerobatic Team in 1994, 1996 and 1998.

In 2006, Goulian was awarded the prestigious Art Scholl Memorial Award for airshow showmanship by the International Council of Airshows (ICAS).

Michael Goulian is co-author of a series of books called Basic and Advanced Aerobatics, published by McGraw Hill, which has become the industry standard for aerobatic flight training manuals.

He is also co-founder of Linear Air, a company that offers air taxi service using Eclipse 500 very light jets and Cirrus SR22 piston-powered aircraft in the United States.

Cirrus Aircraft has been one of the main sponsors of *"Team Goulian"* in the Red Bull Air Race World Championship seasons since 2014. Goulian flies an SR22 for his business and personal travels.

Mike has been married to Karin Goulian since 2000, and he enjoys skiing, playing ice hockey and golf. They have a daughter, Emily, who was born in 2006.

Keith E. Young

Director of Programs and MASM Aviation Ambassador Joins Board of Directors

Keith Young is a member of the MASM Steering Committee and serves as Aviation Ambassador and lead technical adviser. He is the Director of Information Services for Tewksbury Public Schools

In this position since 1999, he is overseeing a Mobile Device Initiative to put laptops into the classrooms of every 4th, 6th & 8th grade class. Additionally, he has implemented multiple technology improvements in the school district as well overseeing the technology planning, installation and management of the new $84M Tewksbury Memorial High School in 2012. Mr. Young holds a certification in ITIL Foundation (Information Technology Infrastructure Library) and he is currently working on his PMP certification (Project Management Professional). Mr. Young has been employed in the field of Information Technology for over 35 years, previously working at the MWRA and two Boston law firms

Mr. Young is a lifelong aviation and space enthusiast and is currently engaged in the pursuit of his Private Pilot certification at Lawrence Airport. He is an avid user of Lockheed-Martin's Prepared flight simulation software to enhance his learning and believes in the use of scenario-based training, including the use of flight simulation to supplement training.

Mr. Young has previously served as the chairman of the North Reading Historical Commission, He has also served as an executive board member on the Tewksbury Historical Society, the North Reading Historical and Antiquarian Society, and the British Iron Association of Massachusetts. He is a member of EAA Chapter 106, Aero Club of NE, AOPA, NEHGS, British Iron Association of MA and many smaller societies and organizations.

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years earlier, and the economy in flying at twice the speed of sound no longer existed. Given the fact that Concorde stopped air service some 14 years ago, relegating all of its supersonic fleet to museums, how can the next generation of supersonic commercial aircraft hope to compete in a market with Boeing's 787 (335 passengers) and Airbus A-380 (500+ passengers on two decks) flying at 500+ MPH? The answer to that question is both complex and diverse.

Engineering is the most significant factor in creating viability, coupled with the availability of new materials being used in aviation, like carbon fiber and advanced lightweight metal alloys. These sleek new machines employ longer length-to-width airframes than the subsonic goliaths that roam the skies between hub cities. These new bullet-like fuselages actually assist in making the aircraft move supersonically, and offer an added value in reducing the sound signature of the airframe when being flown above Mach One, the speed of sound (767 MPH, or 340.29 meters per second).

In the 1940s, a young US Air Force captain named Chuck Yeager flew above that speed for the first time, breaking what was known as the "sound barrier." Since then, the only thing holding back the speed of aircraft is the sonic boom that comes with exceeding that rate of speed. Commercial and corporate aircraft are prohibited from flying faster than Mach One over populated land masses. And, since transcontinental flights are where a substantial portion of profitable markets reside, until now it hasn't made sense to develop supersonic aircraft. But, what if they didn't make so much noise?

Although none of the testing by any of the companies thus far has completely eliminated the customary thunderous sound that accompanies flying above Mach One, some have managed to reduced the impact of the shock wave that can be heard on the ground. NASA, working with the infamous Skunk Works at Lockheed Martin, has eliminated the sound signature known as the N-wave on its X-Plane. The shock wave that causes sonic boom is caused by the aircraft moving faster than the sound waves that it generates. By incorporating laminar designs into the fuselage as well as the wings, the N-wave is reduced from 105 PLdB (perceived level of noise in decibels) to less than 75 PLdB on the ground. That translates as a heartbeat-like-thump as opposed to the former china-rattling shockwave. The famed *Concorde's* sonic signature was 105 PLdB, which is why it wasn't permitted to fly over the continental United States.

Certainly it will take time for the Federal Aviation Administration to ease up on the trans-continental noise restrictions. But NASA is helping to prove the theory and pave the wave for a new generation of ultra-fast jets to fill not only the sky, but growing markets in both the commercial and corporate sector.

"*Time is money*" is a hackneyed saying, but it's true. Traveling to and from destinations for meetings and engagements accounts for a substantial portion of time in the life of a corporate executive, politicians, and even entertainers. Even the average business traveler has an increassed need for speed. To paraphrase the ad campaign of Viking Cruise Lines, people want to spend less time getting there, and more time being there. While the desire to achieve speed is great, the costs associated with supersonic travel are still enormous. But, a Boston company is working on a solution that will bridge the divide between speed and economy for the corporate world.

Spike Aerospace has joined the race to build a viable S.S.T. that will be fast, thrifty to operate, offer a diminished sound signature on the ground, and feasible for both corporate and commercial markets. It is estimated that their delta-wing model S-512 will cruise at Mach 1.6 (1,100 MPH), carry up to 18 passengers, have a range of 6,200 nautical miles, and offer a sound signature that is significantly less than the 75 PLdB target level. In addition, the S-512 will incorporate a multiplex digital cabin

that provides passengers with an unobstructed view of the environment outside the aircraft. These are real-time images produced by 360° cameras outside the fuselage and projected onto cabin-length high-definition color screens. These screens can also be used for watching HD -movies, streaming live events via the internet, or for presentations such as PowerPoints. In addition to high-speed internet availability, there will also be an in-flight telephone system. These technical capabilities will let passengers interact seamlessly with their offices and homes, and allow meetings to be conducted even while traversing the globe. "I believe in our vision," said President and C.E.O. of ***Spike***, Vic Kachoria, who stands firmly behind his team and the corporate goals. The S-512 is being designed for passenger luxury coupled with maximum efficiency, all at an operational cost-per-hour that is priced to compete.

Aerion Corporation AS-2

But ***Spike Aerospace*** is not alone in its pursuit of the high-speed air corridors of the future. There are a handful of other U.S.-based companies that are developing their own supersonic transports in an effort to capture the corporate and commercial markets. ***Aerion Corporation*** of Reno, Nevada is working on their AS-2, a sleek T-tail, trapezoid-wing design that it claims will do Mach 1.5 with a 4,750 NM range. Projected for the corporate market, the maximum number of passengers stands at nine, and a crew of three.

Boom Supersonic of Denver, in association with Richard Branson's *Virgin Galactic*, and The Boyd Group International, boasts that their designed supersonic airliner will do Mach 2.2, carry 55 passengers, have a 9,000 NM range, and offer "business class profitability." But their advertising says the aircraft will move at only 1,451 MPH, which translates to Mach 1.9, a speed substantially slower than the Mach 2.2 claimed; 225 MPH slower, to be precise.

Boom **XB-1 and Airliner**

Boom's one-third size demonstrator aircraft, the XB-1, is currently being constructed and will fly sometime in 2018. Yet, according to the B.B.C., ***Boom*** claims it has five different commercial airlines placing orders for the production of 76 aircraft, all before the performance statistics of their prototype have been acquired, much less any data for their actual proposed airliner.

Lockheed Martin's Skunkworks, in cooperation with *NASA*, has been building the X-Plane: a giant two-man-crew aircraft that will dramatically reduce the sound dispersion associated with supersonic flight. Known as the QueSST project (Quiet Supersonic Transport), *Lockheed Martin's* Palmdale, California plant is focused primarily on the objective of reducing the sonic boom that has invariably accompanied flights flown over 762 MPH, and reduce it to something more palatable to those on the ground below. The obvious objective involved is

to provide the F.A.A. with the data that will eventually lift the trans-continental band for supersonic flight. As helpful as this project may be in establishing a theory of design, *Lockheed* may have difficulty turning the knowledge gained into a commercial success. The X-Plane is a modern airframe which incorporates laminar technology along the entire fuselage, as well as on the horizon and vertical surfaces over the wings, the rudder and the stabilizers. Aside from the pilots, it offers no payload capacity, which is essential for commercial and corporate viability. In the past, *Lockheed Martin* has focused their efforts on special aircraft for military use. But it is possible that the company will shift gears and begin to concentrate on the corporate and commercial markets that are crying out for the technology of speed.

***Boom* and NASA's X-Plane**

There are a host of other contenders in the broader world arena, like the ***Aether***; a set of delta wings that sprout from a bulbous fuselage that conceals a pair of enormous engines inside its belly. The European-Design ***Lapcat A-2***, claims to be able to reach Mach 8. But, like the arithmetic used by ***Boom***, the 5,280 MPH projection rises to only Mach 6.9; more than 800 MPH less than their claim.

The concept that takes the cake is ***The Skreemr***; a design idea from Charles Bombardier. This aircraft is more spacecraft than the other conventional air-breathing jets, because it employs actual rockets to lift it to heights where ramjet engines can take over and hurl the machine at speeds of Mach 10, or almost 8,000 MPH. If it ever lifts off the earth, New York to London will take less time than a subway ride from Jamica Plain to Cambridge on the MBTA.

Meanwhile, just like the manned-space program itself, supersonic flight is an undertaking that requires conquering many diverse elements through revolutionary engineering. Concerns over friction, and the associated heat build-up that comes from friction with the air itself, will play a major role in the development of supersonic aircraft. Modern materials account for some of the progressive changes that will be realized. Both the leading and trailing edges of control surfaces will need to be able to withstand tremendous temperatures and, simultaneously be rigid and/or even flexible enough to stand up to vibrations and harmonics that would doom conventional airframe designs to certain destruction.

Windows on jet aircraft present multiple problems when it comes to supersonic flight. They are heavy, and SSTs need to be as light as possible. Windows are the source of lots of friction on the outside of a craft, thereby slow-

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Oshkosh AirVenture 2017

Going to Oshkosh – You Know You Want To

By Keith Young

During the last week of July each year, the city of Oshkosh, Wisconsin becomes the focal point for the world of aviation enthusiasts. For that week, the place known as *Wittman Regional Airport* (OSH) *b*ecomes the busiest airfield in the world. This year, almost 600,000 people, and more than 10,000 airplanes congregated on the acres upon acres of *terra firma* to commune and celebrate the ability to soar above the earth. Highlights of the 2017 ***AirVenture*** included airshows with the famed *Blue Angels*, a celebration of 50 years since the launch of the Apollo space missions, and a special visit by Stan Lee, the creator of Spiderman and the Incredible Hulk, who announced a new aviation-themed superhero: ***Aviore***.

The event is hosted by the *Experimental Aircraft Association* (EAA), on the grounds of their museum. It is where manufacturers of airplanes and aviation products announce their new lines, where people come to meet old friends, where aircraft home-builders come to learn new skills and share secrets, and where enthusiasts come to be immersed in all things that fly.

AirVenture, as it is officially known, is big! If a typical regional fly-in event is a Cessna 172, then Oshkosh is a Boeing 777. To set the proper expectations you should know up front that you can't see everything. Even if you start on the first day when the gates open at 7:00 am and go until 10:30 PM that night, repeating the process every day through the last day, you can't see it all. There is an airshow every day! At 2:30 every afternoon, like clockwork, the majority of people halt conversation, stand at attention, put their right hand over their heart and join in their patriotic reverence at the playing of the Star-Spangled Banner.

Aside from the daily airshows, there is a hot air balloon glow, a feature movie presentation (*Sully, Hidden Figures, Star Wars: Rogue One*), a concert by well-known artists (this year was the *Bare-Naked Ladies*),

and two evening airshows. The night time airshow is where some of the participants strap fireworks to the wings of their aircraf,t or a team of powered parachute aviators light the rings encircling their fans, and perform various acrobatic feats.

Planning is needed to get the most out of the ***AirVenture*** experience. The place to start, well in-advance, is the website: **https://www.eaa.org/en/airventure** Take some time to study the pull-down menus, especially those that cover "Flying In" and "Planning Your Trip."

First, you will need a place to stay. Camping is available on-site at Camp Scholler, a campground dedicated to the ***AirVenture*** event with facilities that cater to needs of the campers. The 11,000+ campsites are within the grounds of the event, and shuttle busses are available to make travel easier. Of course, if you choose to fly your own plane into the event, camping is allowed on the piece of ground where you tie down. Hotels and motels are available throughout the city and the surrounding communities, although these can be quite pricey. Houses are also available for rent and this may be an economical choice when going with a group. Also available are the dormitories of the University of Wisconsin at Oshkosh. A dorm room consists of two beds, a refrigerator, microwave and air conditioning. Book early as availability for space fills up fast.

If you're flying in, it is best to experience at least a couple of regional fly-ins before making the attempt. Notices to Airmen are available in advance of the event and should be studied and understood. Flying in during the peak days (Monday or Tuesday) can be quite daunting. Also, most who fly in depart either Saturday or Sunday morning, so keep that in mind when planning departure. Some stay at ***Fond du Lac*** (FLD), or other nearby airports.

Fly commercial and the best bet is Chicago, Milwaukee or Green Bay. Amtrak has service from all US points to Milwaukee. From there connection north to Oshkosh can by via bus service, or a car can be rented to drive the last 75 miles up I-41. If you rent a car, you should consider buying a parking pass in advance. There are a number of different parking lots, but you will probably not be given a choice.

You will need an ***AirVenture*** admission ticket. It's possible to buy a daily or a week-long ticket. If you are an EAA member you qualify for a discount and, if you book before June 15th, you get an additional early-bird discount. You must be an EAA member to use either the app or website for saving your itinerary, and, unfortunately, not every event gets listed in the electronic schedule. Check the websites of other groups like AOPA to get details of their events, and stay flexible with scheduling in order to attend the workshops you fancy.

Of course, you will also want to make time to just see

the planes. The grounds are separated into groups so that viewing a particular genre is easier. There is a homebuilt section, an ultralight, rotorcraft, vintage, and a warbirds section, complete with a military style encampment. Many of these groups have a daily session where a specific style of aircraft or even a specific aircraft is highlighted. This year, being the 75th anniversary of the bombing of Tokyo, the B-25 Mitchell was represented in force. Ten airworthy bombers were aligned on the *Warbirds Plaza* as if they were on the flight deck of the USS Hornet, preparing for departure to bomb the capital of Japan. Dick Cole, the remaining survivor of the Doolittle Raiders, made several appearances and was interviewed from the cockpit of the Larry Kelly's B-25, *Panchito*.

Many of the most noteworthy aircraft are positioned near the event center at *Boeing Plaza*. This year, *Boeing Plaza* hosted a B-1B Bomber, a B-52 Bomber, *Proteus* by Scaled Composites, the Blue Origin spacecraft and the only airworthy B-29's, *Doc* & *Fifi*. ***AirVenture 2017*** also saw a pair of B-29s take to the air together for the first time in over 50 years. The *Four Corners* is the center of the event marked by a compass rose painted on the walkway. It is here there is a place to cool down if it gets too hot at the Welcome Center. There is a tent dedicated to enhancing piloting skills, as is the EAA Membership tent, where you can purchase EAA merchandise and check on the status of your membership.

One venue that you will want to put on your list is the EAA Museum. The museum houses unique and unusual aircraft, many of which formed the groundwork of what EAA is today. Nestled behind the museum is *Pioneer Airport* (FAA LID: WS17), where helicopter rides can be enjoyed, and where noteworthy aircraft are displayed. There is ***Kidventure***, where young people can try their hand at sanding a propeller, creating a balsa glider or creating a spruce wing spar. There is even a grass runway where vintage planes can land, and it is here that Ham radio operators communicate with people around the world.

Want to get into the air? Flights are available on the B-17 *Aluminum Overcast* as well as flights aboard a Ford Tri-motor. At the ultralight area, it was possible to arrange a demo flight in/on a tandem powered hang-glider.

While airplane manufactures dot the outskirts, most vendors for items other than airplanes, are in the four hangers: A, B, C, & D. Here you'll find electronics, charts, airparks, getaways, and hanger doors. There are sunglasses, massage chairs, aroma therapy, windsocks, jewelry, watches and flight training. Located behind the D hanger, is the section known as the *Aeromart*. In addition to T-shirts and signs for your hanger walls, you might find cutlery, plastic models, and used airplane parts.

A hidden gem of ***AirVenture*** is only five miles southeast of the airfield. The Seaplane base is in a small

cove along Lake Winnebago. The $3.00 shuttle ride will drop you off at a pathway that leads to a serene lagoon. It is worth slipping away to take a boat ride around the cove. You should figure about 2 ½ hours portal-to-portal.

Plan to walk! Five miles or more per day is average. There are small electric carts for rent outside the main gate, but most people just hoof it. There is a great transportation system of trams, and it is recommended that you familiarize yourself with the tram system. The trams don't run before 8:00 AM, nor do they operate much after the end of each day's airshow. They also tend to become very crowded as the week progresses, especially at the intermediate stops. While standing on the tram is not allowed, most riders are willing to try to squeeze one more in if there is room.

The busses can get very crowded as well. The main terminus for the busses is known as the *Bus Park*. This is an area outside the main entrance. During peak times, such as immediately following an airshow, the lines can get very long when trying to board one of the busses. Sometimes it is faster to walk than to wait for a bus, but typically the busses are very convenient and faster than hiking.

There any number of options when it comes to *dining* (stated euphemistically) off-campus. In the past, the choice was hamburgers, cheeseburgers, or maybe even hot dogs. Not so anymore! The restaurants of the area have climbed aboard with some of their most popular dishes. Wisconsin bratwurst and fried cheese curds are available at multiple locations. Savor Shrimp Louie (from *The Roxy*), or a turkey rollup (*Mechanics Garage*). Enjoy a breakfast sandwich with bacon, egg and cheese (*Fightertown Grille*), a ham, egg and cheese on English muffin (*Thunder Bay*), or a ham, egg and cheese croissant (*The Roxy*). Some prefer Caesar salad (*Major Goolsby's*), or a chicken parmesan sandwich (*Saz's*). There are a couple of *Subway*® on-site, locations serving corn on the cob, and *A&W* root beer floats and ice cream. In addition to their printed menu, *The Roxy* had daily specials posted as well. If you can manage to stagger eating times to late morning and mid-afternoon, the lines are more manageable. By Saturday evening several places had run out of food, and lines were very long at the one's still serving, so plan to bring snacks just in case. Beer and wine are available at *Thunder Bay*, and at some venues just outside the main entrance. The food is served fairly quick and was reasonably priced.

Breakfast at the campus of the University is a decent deal if you are a big breakfast person, and is only $9.00 for all you can eat. The offerings included eggs, sausage, breads and muffins, cereal, coffee, juice, pancakes and waffles, fruit and any number of other breakfast items. The advantage is being able to get an early start by taking the 6:30 AM bus from the University. Lunch and dinner are available at the University at *Blackhawk Commons* for cost of $15.00, and they provided a good menu each evening, serving until 8:30 PM. Beer and wine are also available with dinner.

The *Dockside Tavern* has adult beverages, and the food was very good and reasonably priced. If given the opportunity, it is worth getting over to *Ardy and Ed's*, a real old-fashioned car-hop, with waitresses on roller skates and old-time rock-and-roll blasting from the speakers. The root beer is made fresh, and their burgers are just how you'd expect them, albeit a little messy.

For most people, T-shirts and shorts or skirts for the women is the attire. Vendors typically wear polo's and slacks. It is mid-summer and you will be outside most of the day. Bring a light jacket, fleece or an over-shirt as It can get cool in the museum and as evening approaches. You should also consider a hat and sunscreen. There is very little shade and what is available is often occupied. As for footwear, avoid anything with open toes such as sandals or flip-flops. Comfortable boat shoes or sneakers will make walking that much more comfortable. Sunglasses are nice to have but not required. As for packing, leave a little room to accommodate one or two new T-shirts to what you bring.

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You will also want to have some type of rain gear. Keep an eye on the weather as the week approaches and plan accordingly, but bring foul weather gear so that you have if needed. Ponchos and umbrellas for sale disappear once the heavens open up.

Bring your camera(s). You'll probably want to take lots of pictures. Bring spare batteries and chargers. There are charging stations scattered about the grounds.

Bring business cards if you have them. You will meet many and will probably want to exchange information with them. This is a fairly easy way to give them your information.

Consider bringing or buying a folding chair. The more light-weight and portable the better. You will want something to sit on when watching the airshow(s) or going to the Fly-In theater. Sometimes it's just nice to be able to sit while waiting for a bus. Consider buying one locally and leaving it when fly home. Portable, collapsible chairs can be had for under $10.00; short money for big comfort.

Bring a daypack. This allows you to carry beverages, snacks, trinkets that you have picked up, brochures, your raingear, hats, and T-shirts that have bought or won. You should be familiar with how the pack wears, and be sure it can comfortably carry a load as well as easily be put on and come off.

If you've always wanted to go to ***AirVenture***, plan to go soon. It is a bit overwhelming trying to plan and take all aspects into account. Additionally, it is not an inexpensive adventure. If possible, plan to stay Sunday to Sunday. Estimates put the cost between $1,200.00 $1,700.00 per person for the week. If you are reading this and have gotten this far, you know you want to go. You now have permission to just go ahead and do it.

Keith Young is a member of the MASM Board of Directors, an avid pilot, and a member of EAA Chapter 106, Aero Club of NE, AOPA, and NEHGS

ing it down. They also account for the majority of cabin noise. ***Spike's*** S-512 is equipped with one window—for the pilot to see where they're going. The cabin has no actual windows, but rather a 360° projected view onto HD screens that are much lighter than a row of windows. The S-512 has a dramatically reduced friction along the fuselage with both laminar design and no windows. This boosts speed, and virtually eliminates transmitted noise into the cabin. Plus, it will get you from New York to London in just three and a half hours, all at a competitive cost.

Since cost was the primary issue leading to the demise of the Concorde fleet, an extremely fine pencil is needed to figure the cost of the average corporate CEO utilizing supersonic flight compared to the cost of flying conventionally with commercial carries. First, there is the hourly cost of the CEO to consider. Then, the amount of time that it takes to get from point A to point B, which is at least twice as long via commercial flights. Then there is the cost of a first class ticket, which is considerable. Add in the cost of hotels, meals on the ground, and the ground transportation to and from those meals and hotels, and it adds up to a tidy sum. That's without taking into consideration the time waiting on the ground prior to boarding an international flight due to security.

With a supersonic corporate jet that is co-owned by several major companies, that same CEO can leave home in the morning for a meeting in London, and be home before dinner is served. And the cost is actually cheaper than standard commercial fares with every additional expense taken into consideration.

The new supersonic corporate and commercial transports are coming in the not-too-distant future and aviation will soon see a rebirth of a super jet-set age.✈

Spike S-512 configured for commercial flight

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