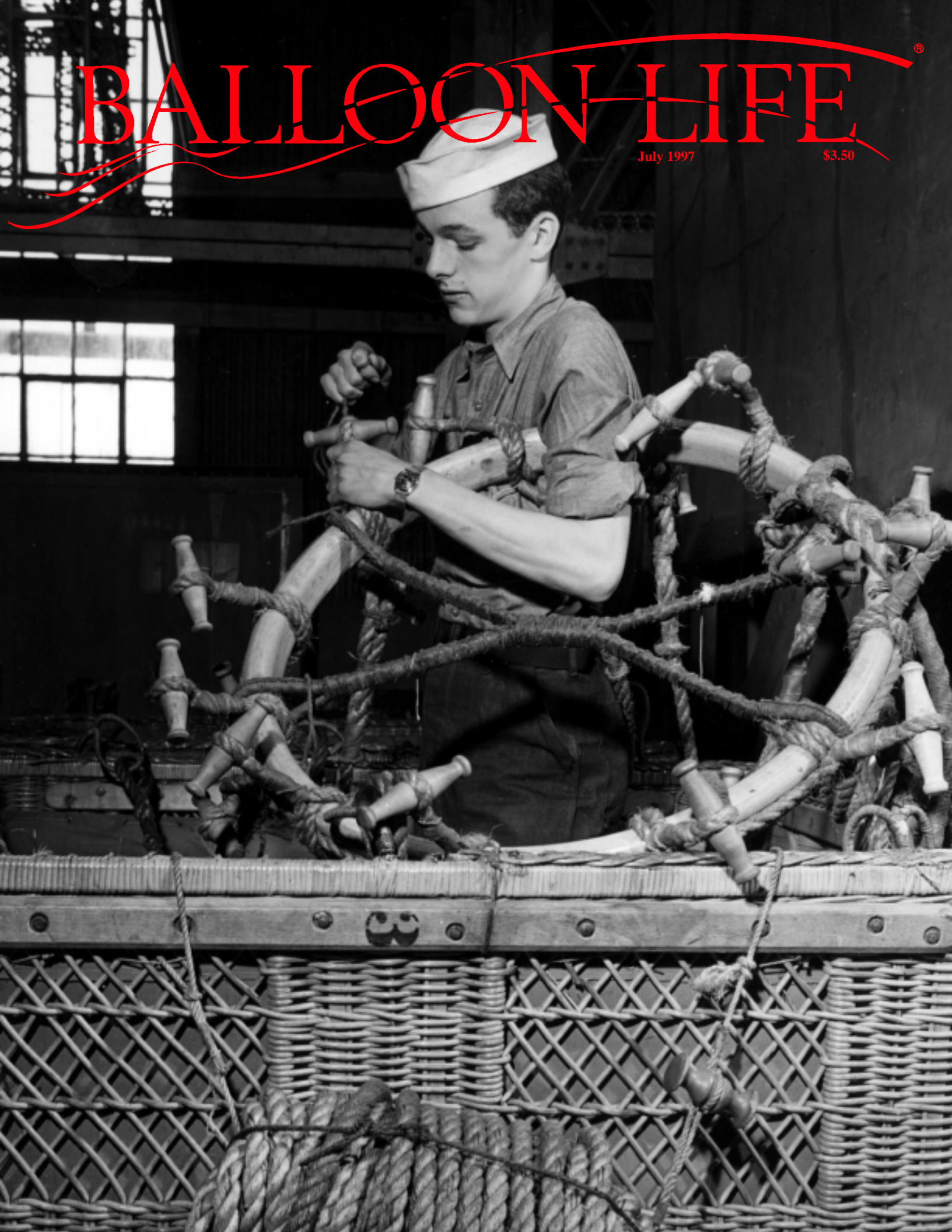


# BALLOON LIFE

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# BALLOON LIFE MAGAZINE

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# EDITOR

## 50 Years

1997 marks the 50th anniversary for a number of important dates in aviation history including the formation of the U.S. Air Force. The most widely known of the 1947 "firsts" is Chuck Yeager's breaking the sound barrier in an experimental jet—the X-1.

Today two other famous firsts are celebrated on television by the "X-Files." In early July near the small southwestern New Mexico town of Roswell the first aliens from outer space were reported to have been taken into custody when their "flying saucer" crashed and burned.

The other surreal first had taken place two weeks earlier. Kenneth Arnold observed a strange sight while flying a search and rescue mission near Mt. Rainier in Washington state. After he landed in Pendleton, Oregon he told reporters that he had seen a group of flying objects. He described the ships as being "pie shaped" with "half domes" coming out the tops. Arnold coined the term "flying saucers."

For the last fifty years unidentified flying objects have dominated unexplainable sighting in the sky. Even sonic booms from jet aircraft can still generate phone calls to local emergency assistance numbers.

Today, debate about visitors from another galaxy captures the headlines. Yeager's historic flight will surely be noted with appropriate marketing opportunities. But 1947 is more notable for another first flight.

In 1947, before Yeager, before aliens, before flying saucers, there was one reported flight that set the course of history for one segment of aviation. On February 16, 1947 Don Piccard lifted off from Minneapolis, Minnesota in a Japanese-made paper balloon. His goal was to stay aloft long enough to earn a balloon pilot rating. A little over two hours later, the mission accomplished, he landed near White Bear Lake, Minnesota.

That flight earned Piccard the first civilian balloon pilot rating to be issued after World War II. 50 years later the "Dean of American Ballooning" is still active in the development and promotion of lighter-than-air flight.

This month *Balloon Life's* special report focuses on Don Piccard's 50 years in ballooning. Our 8100 word article and 23 photographs barely scratch the surface of his life-long endeavors and adventures.

Throughout the last 50 years he has been at the forefront of promoting lighter-than-air flight. Soon after leaving the Navy at the end of the war, he tried to form a balloon club. When Yost made that first historic flight it was Piccard who saw the possibilities in the new thermal balloons. When you talk to Don you can hear in his voice the joy and delight that ballooning gives us all.

My first contact with Don was in 1983 soon after taking over as editor of *Pilot News* (today known as *Skylines*), the monthly newsletter of the Balloon Federation of America. He was my predecessor, fired from the volunteer position for too much openness and debate. Debate he thought would make for a better and richer sport.

Piccard has been a champion of ballooning for more than 50 years. He continues to be active in ballooning with his recent design of the Pleiades Seven, his contributions to this publication, and sharing his vast wealth of knowledge answering questions on the Internet.

*Don Piccard - 50 Years in Ballooning.* The journey begins on page 26.



Editor



by Peter Stekel  
photographs courtesy of  
Don Piccard

**D**on Piccard's list of firsts is impressive - and almost endless. Piccard made the first post-World War II free flight in 1947, with a captured Japanese *Fu-Gos*; a small, hydrogen-filled paper balloon. In 1948, he organized the first balloon club in the United States; the Balloon Club of America. In 1957 he flew in the first plastic gas balloon, the *Pleiades*. The *Pleiades*, his design (based on his father's idea), is also a first as it consists of not one envelope, but a cluster of seven; just like the famed Seven Sisters of Greek mythology.

What else? Piccard did some of the first work in using laminated Mylar for superpressure balloon envelopes. In the 1960s, he was instrumental in getting hot-air ballooning recognized as a serious sport when he organized the first balloon races. And in 1963, along with Ed Yost, Don Piccard was the first to fly the English Channel in a hot-air balloon. The first hot-air balloons sold in Europe and South Africa were built by Piccard's company and a Piccard-manufactured balloon, *Red Dragon*, was one of the first three that launched hot-air ballooning as a sport in England.

Taken as a whole, Don Piccard's accomplishments are awe-inspiring. Not bad for a guy who flunked calculus (or Calc-useless as it is also known) twice and, like Ed Yost and Tracy Barnes, never graduated from college!

*Don Piccard lifting off from Minneapolis, Minnesota February 16, 1947.*

# Don Piccard-50 Years of Ballooning Memories

## Early Years

One of three children, Don Piccard was born into ballooning. His parents, Jean-Felix and Jeannette Piccard were balloonists and young Don made his first flight in 1933 as a "crew member" for his mother. Jeannette Piccard was fortunate enough to have hooked up with an instructor, Gordon Bennett-winner Ed Hill, who flew out of the Ford airport in Dearborn, Michigan. Automobile-maker Henry Ford took an interest in the project, allowing use of his hanger, and became instrumental in that 1933 flight being a success. He also brought Orville Wright around and Piccard remembers that seminal occasion, "One of the great experiences of my life was to shake hands with Orville Wright. I was a little kid and he payed attention to me. He was a very, very nice old man."

Piccard tells the story of a test flight his mother made with Ed Hill. It turned into something special, and exciting for Jeannette Piccard. Remember, this was in the hydrogen gas balloon days. They were flying along when Hill valved out some gas and reduced ballast by unloading sand. "The balloon rounded out at tree top level and they flew through the tops of apple trees." Being springtime in Michigan, the trees were in bloom. Hill leaned out over the edge of the basket and came back with an apple blossom behind his ear and a big grin plastered on his face, "Just the happiest man alive."

Piccard's father, Jean-Felix, had been involved as a balloonist during World War I while serving in the Swiss Army. Piccard *Pere* taught his son the value of safety. Don Piccard remembers, "Everything he did, he was very, very cautious," including playing with bears in Yellowstone National Park back in 1916. "Everything I wanted to do," no matter what, "he was with me, emphasizing the safety aspects." This safety awareness, instilled early in life, was to serve Piccard well during his years as a balloon designer.

The older Piccard was initially a chemist and explosive's engineer for Hercules Powder Company. He first flew for scientific purposes with his twin brother, Auguste, in 1913. Jean-Felix Piccard, flying with his wife Jeannette, set a stratospheric altitude record for the USA of 57,037 feet (11 miles or 18 kilometers) in

1934, surpassing brother Auguste's 27 May 1931 record of 51,762 feet (15.781 kilometers).

To understand the importance of these accomplishments, you must realize that previous ascents had shown that flying into the stratosphere could be fatal and that to penetrate the isothermal layer, with its low pressure, a new kind of balloon would have to be built. Auguste Piccard built such a balloon in 1930, equipped with a pressurized, air-tight cabin and an envelope large enough and with sufficient ascent strength that, on departure, it need not be completely filled. This important feature is explained by the Universal Gas Law. As a balloon rises into the atmosphere, gases within the envelope will expand, increasing pressure, as the atmospheric pressure outside decreases.

Other innovations from the twin brothers included a frost-resistant window for high altitude balloon gondolas and an electronic system for emptying ballast bags designed by Jean-Felix. Jean-Felix also experimented with plastic balloons and helped design the polyethylene Skyhook series of high altitude balloons that the United States Air Force used for manned flights. The Skyhooks rose to over 100,000 feet to collect upper atmospheric weather data.

Auguste Piccard developed the bathyscaphe for exploring the deeper ocean reaches where intense water pressure creates massive design problems. So, you might say that firsts run in the Piccard family.

## First Flights

You might also say that the shape and form of hot-air ballooning today is a direct result of Don Piccard's energy, enthusiasm, and vision. It all began, 50 years ago, in 1947 with a flight in a captured Japanese paper balloon, the *Fu-Gos*. Incidentally, the paper used came from the Mulberry tree, famed as the preferred haunt of the silk worm.

During World War II, the Japanese military had the idea of loading 5-15 kg of explosives onto cheap, mass-produced, hydrogen balloons and then setting them free to wander the friendly skies. The plan was that wherever they touched down along the west coast of America, they would explode; a terrorist's dream.

Of the 9000 or so *Fu-Gos* launched

between November 1944 and March 1945, 285 balloons made recorded landfall, stretching from Alaska to Mexico. Six deaths and minimal damage occurred from the wayward wandering balloons that had to cross over 6000 miles of ocean. It was one of these errant 285 that Piccard used for his 1947 maiden solo flight. He had spent 1944-46 as a balloon airship rigger for the Navy and this gave him just enough practical experience to pull off the flight. It also sparked his interest in improving balloon design.

As expensive as ballooning remains today, it was outrageously prohibitive in 1947. Piccard, at the time a Minnesota resident, was able to get the *Minneapolis Times* to help sponsor the flight and buy the hydrogen. He recalls, "The Army Reserve, the Air Force Reserve that is, gave me the aluminum to make the basket. The University of Minnesota Medical Laboratory helped me make the basket. Acme Metal Spinning spun the aluminum valve." The Reserve Officer's Training Corps, another sponsor, had Piccard fly in a uniform with specially designed insignia. "They had just formed the United States Air Force (USAF) a few days before," so reservist Piccard may have been the first USAF pilot to make a flight.

Except that he wasn't really a pilot yet. By the end of that flight though, two hours in the air and no written test, Piccard was the first FAA certified balloon pilot. Not that the FAA had any idea of what to do with this new category. You see, there wasn't much interest in ballooning back then because either you couldn't get a balloon or the hydrogen to fill it was unobtainable. In France, Charles Dollfus, a renown gas balloonist from before the War, was still practicing the art but sport ballooning was non-existent anywhere else and possessed as much future as an ice cube in a blast furnace.

Before his 1947 solo flight, Piccard attempted to organize 15 ex-Navy pilots into a balloon club in Minneapolis. He recalls the enthusiasm of the first meeting flagging when participants realized, "We'd have to build our own balloon; that we didn't have anyone furnishing one for free, and that we'd have to fly with hydrogen because helium wasn't available for sport balloonists." Nobody showed up for the club's second meeting.



Clockwise from top left: Piccard in red jump suite with burner/blower on station wagon tailgate. Piccard trailer in foreground. Holding back pressure against blower to get flame started; Piccard launching in aluminum "basket"; Willie Piccard, Don's second wife, launching from Indianola, Iowa, August, 1972 in A-1 helium Mylar balloon. Flight set a world record for duration; September, 1965 Reno, Nevada. Ed Yost in white "Taco" balloon in foreground, Don Kersten's "Merope" white balloon in background), a Semco pink and white balloon, and Lloyd Muma in a green and white balloon with pointed top; Deke Sonnichsen's first flight in his back yard with a Piccard AX-3; 25 foot diameter 5 mil Mylar Scheldome; Piccard S/N 1 at Bermuda Dunes, California 1965; (center) Raven S-40 deflation.



*Don Piccard soon after liftoff, February 16, 1947 in a Japanese made paper balloon.*

His next flight, following the *Fu-Gos* balloon, was the next fall in a 35,000 cubic foot war surplus balloon Piccard bought for \$10 from Barney Frank in New Jersey. Frank had gotten his hands on a set of balloons and had been selling them to interested parties. Evidently the balloons were in great shape and, "Somebody didn't realize they had been surveyed as unfit for flight and sold as war surplus!" Piccard chuckles over the memory. "We just put them right back into service!"

Frank had picked up the balloons at auction a short time before. When the bidding first came in, several people saw that they were advertised as "Free" balloons. So, they bid, "Free-ship it!" Eventually, Piccard bid \$10 for the lot, somebody else bid \$10. The supply officer at the auction was dismayed at the low bids and said, "These balloons cost the navy \$20,000 to build; I'm not going to let them go for \$10. All bids are canceled!" Piccard replied, knowing that the balloons, no matter what their condition, were useless to the military, "Commander: how much do you get for your second hand toilet paper?" The officer blew up and threw Piccard out of the auction. Finally, Barney Frank bid \$100 and got them all.

Since there was no such thing as nationwide organized sport ballooning in those days, Piccard suspects one reason the Navy allowed the surplus balloons to go on the auction block was tradition. The custom before World War II, as also practiced in Europe, was to allow civilians

who were interested in ballooning to pick up extra military balloons at pennies on the dollar. "I think there was an understanding," between the Navy and Barney Frank, "that they would sell him the balloons at his bid if he would let half of them go to sport balloonists to further aeronautics in the country in the national interest."

As Piccard recalls, "I don't know anyone in this country who bought a new sport balloon after World War II." All the pilots flew war-surplus craft. Those \$20,000 balloons would, "probably cost \$200,000 in today's money, which is absolutely impossible."

One club, in Cleveland, was somewhat organized before the War. They had ended up with the old Detroit Balloon Club balloons. "The Cleveland Balloon Club had flown off to war and left all their balloons with one of their student pilots." The student pilot's wife didn't like balloons and she gave all of them and all their equipment to the Salvation Army to haul away except for one 80,000 cubic foot net. As Piccard tells the story, "The student pilot figured, even though his wife made him get rid of the balloons, he would be able to use the net as household twine." So he saved the net and then five years later, in 1950, when Piccard got in the news, this student pilot contacted him and offered to give him the net, just to get it out of his garage. Piccard jumped at the chance to get another ex-pilot, even a student ex-pilot, involved again in ballooning and replied, "I don't want the net; I want you."

Back in September of 1947, Piccard was living in Swarthmore, Pennsylvania, "hanging out with the guys at Lakehurst," and got his hands on a 35,000 cubic foot war surplus Navy gas balloon. For fuel, he used coal gas and was able to fly three people. In telling this story, fifty years later, Piccard reaches for his log book and reads, "We took off at eight o'clock in the morning... landing at a little after noon... Pleasant Valley, Pennsylvania... no mention of how much ballast I had... just three people." He pauses and muses for a moment. "But it must have been a lot. You could get a lot of lift with coal gas!"

As an aside, it is interesting to note that Don Piccard's flight log books are wonderfully replete with details. He not only includes his time of departure and arrival, he lists his companions, weather conditions, specifics about fuel, ballast,

balloon design, and a host of other information that helps serve his memory and provide a living history of ballooning over the past five decades.

In 1947, the world had only recently emerged from six years of destruction and was on the verge of entering the deep freeze that Winston Churchill termed the "Cold War." Espionage and national security were to become hugely important and newer methods of spying on other countries were in the offing. Somebody, with creative thoughts, was turning minds to high altitude airplanes with fine optical equipment. But other minds were thinking of how gas balloons might be used for surveillance and, secondarily, recording weather data. The only problem was that balloon technology could not support what people wanted to do with balloons.

So, where did Don Piccard see his life going in 1947? He had dropped out of college and was working in sales and building construction. "I thought I'd end up being a developer of some sort." He had some good friends who were involved with real estate developing and building and Piccard thought he'd hook up with them. Instead, he eventually found himself working with materials that would one day enable the Cold Warriors to live out their dream of high flying balloons.

### **Forms Balloon Club of America**

In 1948 Don Piccard teamed up with Peter Wood and some others in Swarthmore, including, finally, Tony Fairbanks, to form the Balloon Club of



*Piccard's landing at White Bear Lake, MN February 16, 1947.*



*Piccard launch in Raven S-40 at the first St. Paul Winter Carnival balloon race.*

America. Douglas Leigh secured eleven surplus envelopes from the Army lighter-than-air program and Piccard managed to get possession. There BCA stood. From the eleven balloons they constructed one 80,000 cubic foot air-worthy balloon and flew it 29 November 1952, making a four hour flight from Swarthmore to Hammonton, New Jersey. After that, they would fly three or four times a year and garner all sorts of front page news due to the novelty of seeing a balloon over a downtown metropolitan area. But, it awaited the innovation of hot-air ballooning before the sport could take off.

After a stint in the service during the Korean conflict, Piccard ended up working for All American Engineering, in Delaware, doing air pick-up work. In those days, little towns without airports would set their mail out on a pole and small planes would swoop down and snag the bag and then fly away, dropping off the other mail by parachute. "If you've seen the movie, *The Green Berets*, where they come out of the jungle and pick up a man; that's the kind of work All American was doing," Piccard remembers. He worked on making their mobile airship mooring mast systems a bit more efficient and safer and got his first patent.

Around this time, Ed Yost was working for the General Mills company on high altitude gas balloons to be used for espionage and scientific projects. Hot-air balloons at the time were smokey circus curiosities and not very functional due to the lack of a means to generate and con-

tain the hot air. Yost's balloons were made of a synthetic, polyethylene, which was heat-welded to a certain shape. Yost attached a plumber's blowtorch to an 8000 cubic foot polyethylene envelope and, in 1953, he flew it. Within a few weeks, he had built a 27,000 cubic foot model that could easily carry a man. Hot-air ballooning had finally left the ground.

### **Begins Work at Schjeldahl**

Referring to his logbook, Piccard remembers the 18th of September, 1957, when he flew the first plastic Pleiades (based upon a design of his father's, Jean-Felix Piccard) from Valley Forge to Spring Garden Pennsylvania. "That got me a couple of pages in *Life Magazine* and that got me the job at Schjeldahl." The original article was going to be a five page spread but events in Little Rock, Arkansas, with Governor Orval Faubus going up against the federal government on school integration, resulted in the balloon flight story being shortened to two pages with a single color photo; no mean feat during the days when *Life Magazine* was a mover and shaker. Gas and materials for that flight cost Don Piccard \$800.

Gilmore Schjeldahl was an independent bag maker who started working with Mylar while everybody else still used polyethylene. "I knew that Schjeldahl subscribed to *Life Magazine* and that he was impressed by *Life*. So when I was ready to make my Pleiades flight, I gave *Life* an exclusive on it, just so that I could get good coverage," with the certainty that Schjeldahl would see it. After the Pleiades flight, Piccard met Schjeldahl in Washington DC and they stayed up the whole night, "talking about what quarter mil Mylar could do in a high altitude flight."

At the beginning of 1958, Piccard moved to Minnesota to work for Schjeldahl. Knowing he couldn't get a job with General Mills and that Raven wasn't interested in him at the time, "Schjeldahl seemed like the place." Schjeldahl, himself, "seemed like a very bright man."

His primary work with Schjeldahl was in research and development, making "Bubble Houses." These were air supported buildings such as greenhouses or swimming pool enclosures. During that time, Piccard got the basic patent on cylindrical air supported buildings. "That's

one of my best patents," he says happily. "That was really fun: Uniaxial stress skin structures." He finally developed an economical air inflated structure that was so economical that there was absolutely no profit potential in manufacturing it. With no proprietary patents or processes in danger, Piccard advocated shutting down the project.

From there Piccard moved on to the superpressure balloon program at Schjeldahl but it was shortly terminated because, "it wasn't going anywhere." Mathematically it should have worked, but they were having no luck with it at the time. It would be over another decade before superpressure balloons would be able to live up to their potential.

The theory of a superpressure balloon is simple. A relatively small volume of helium fills the total envelope but as the balloon rises, the gas expands. Gradually, the entire bag is filled, displacing atmospheric air and continuing to lift the payload. When float altitude is achieved, excess gas is vented to avoid continual stress on the super light-weight fabric of the envelope.

The continuing problem with superpressure balloons is that they have an extremely limited flight duration. This occurs because incoming solar radiation during the day expands the gas, with a resultant loss through the vents. At night, the gas contracts and the balloon sinks.



*First plastic Pleiades cell.*

Still, a superpressure balloon of 10 million cubic feet can carry a ton or more of equipment over 30 miles high and do it far more reliably and economically than conventional satellites. And at roughly 60 pounds of lift per 1000 cubic feet of envelope, gas balloons deliver three times as much lift per volume than hot-air balloons.

"I think part of the reason I got to handle the job of the superpressure balloon was that the contracting fellow from Cambridge enjoyed to drink too much. Dick Slater, a good Lutheran teetotaler, didn't like to handle that guy." Ironically, when some of the people overseeing the project came to visit Piccard to see how he was doing, he took them to a local tavern where an air supported building had been step up over the outdoor drinking garden. "See that bubble?" Piccard bragged. "They throw broken beer bottles at it and it holds up." The government team was impressed and wanted to know the secret.

The answer to the mystery was simple: laminated Mylar. Piccard had discovered that single layer Mylar would wrinkle and was so stiff that it damaged itself. "When you take two thin layers of Mylar and laminate them together with a self-adhesive between them, they tend to feel more like leather than like sheet metal and it isn't self-destructive." His idea was to make a superpressure balloon, not out of one mil or two mil Mylar, but out of two thin layers of half mil Mylar, laminated together. That way the material would be flexible and the envelope wouldn't break itself

apart. Coincidentally, John Piccard, Don's brother, designed the machine that was used to make the Mylar!

They went ahead, using the laminated material, and had the first successful superpressure balloon design based on that concept. This unleashed a flurry of balloon designs using laminated Mylar for trans-Atlantic balloon flights and for high-altitude research.

successful flight with a hot-air balloon and Piccard said, "That's where I want to be!"

## Joins Raven and Begins Promoting Sport Ballooning

Raven Industries hired Don Piccard to manage their nascent sport balloon program. "They had no idea of what to do with a sport balloon," he says emphatically. "They had no knowledge of what to do with it." But, "I had design responsibilities," he recalls, and after flying their Mittlestadt balloon, "I set about designing a version that would be closer to the balloon Yost had built for the government." At the helm of Raven, Yost was being financed by the Office of Naval Research on top-secret hush-hush projects.

During his years at Raven, between 1962 and 1964, Piccard devoted his energy to marketing the *Vulcoon*, one-man thermal balloons. Stressing his lack of security clearance at the time, Piccard says he worked strictly on sport balloons and had no contact with any of Raven's military contracts. Be that as it may, following a 1987 interview in *Balloon Life* with Don Piccard, where he described his civilian work with



*Piccards (right) and Johnsons with four foot diameter gondola and LOX converter for Golden Bear flight. Johnsons spun gondola—father spun for Jean Piccard's Stratolab gondola and son spun for Don's record flight.*

To this day, Piccard isn't sure that a Mylar superpressure balloon would be a good, general, all-purpose balloon. "It's really on the edge. There is no room for error. It's not really viable."

Continuing at Schjeldahl with his successful applications with Mylar laminations, Piccard designed Mylar diaphragms for the Polaris missile. While that was going on, Ed Yost had made his

Raven, the CIA library in Langley, Virginia, began to subscribe to the magazine.

At this time, Piccard also concentrated on making contacts in the aviation field and in organizing the first modern Montgolfier-style balloon races. The races brought the fledgling sport more attention and interest and Piccard can rightly boast that, "If I have done anything, it is to make the sport of ballooning a sport that people





*Clockwise from top left: Piccard balloon with a "chimney" skirt; Piccard (left) in Japanese fur flight suit prior to altitude record flight of 34,462 feet in 1961. Flight suit and aluminum gondola both used on February 16, 1947 flight; Piccard standing next to his "body helmet" design gondola; modern Pleiades gas cell; Piccard ascending on altitude record flight 1961 using Schjeldahl S-10 Mylar laminate balloon. American flag used by his mother, Jeannette from her altitude flight in 1930s; "Spirit of Seventy Six" Piccard 105, March, 1972; (center) new Piccard top in operation.*

can get into and enjoy without restrictions.”

Ballooning’s early days not only required a lot of money, it also compelled pilots to circulate in different social circles. Ballooning was a dirty sport; a “filthy business,” Piccard remembers. Professionals: stockbrokers, doctors, politicians, or anybody in the public eye, wouldn’t get involved in the sport because every flight was such a *cause celebre* that the newspapers came out and, “You’d get your picture in the papers.” Nobody wanted that.

It was even worse with hot-air ballooning. “Wally Soley used to say that in the old days they wouldn’t let him check into a hotel until they sent a bellboy up to take the sheets off the bed!” Who can say if this was because hoteliers were afraid the pilots would steal the sheets to repair the balloon or because, “The sheets would be worthless because they’d be soaked with India ink!” India ink is carbon soot and water and, “A smoke balloonist’s body sweat was India ink: indelible, dirty, grimy.” In summing up his early work in popularizing the sport, Piccard says, “It’s hard for any balloonist today to comprehend the general public’s attitude towards balloonist during those days and that’s what I had to change.”

One major way the public’s attitude about ballooning changed in 1962 was from Don Piccard’s first organized balloon race. It was 28 January, the birthday of Jean-Felix Piccard!

In the old days, the real old days, balloon races were more social than competitive. That all changed on 30 September 1906 when newspaperman, James Gordon Bennett jr., got involved. Bennett was the kind of newspaper owner and promoter who could go through money like grease through a goose. He supported motor races (boats and cars), sponsored tennis tournaments, introduced polo to the USA, and in 1871 had sent Henry Morton Stanley to find explorer Dr. David Livingston at Ujiji on Lake Tanganyika in central Africa. The Gordon Bennett race became the first international balloon event, the winner being the pilot who could travel the furthest. Distance was measured from start-to-finish in a straight line.

That first race reportedly drew 250,000 enthralled spectators at the lift-off in Paris. Sixteen pilots entered the race

and the winner, Frank Lahm, from the USA, traveled 395 miles in 22.5 hours. Over the next 33 years, the Gordon Bennett race was held 26 times until the invasion of Poland, September 1939, stopped the event.

To give Piccard’s first race credibility, he didn’t want it to happen unless he could get a respected organization to host it. “The St. Paul Winter Carnival said OK, as long it didn’t cost them anything.” Next, “I went out and got sponsors and got the money and I went out and bought a Sterling Silver Revere Ware Bowl as the trophy. I wanted to give this thing the attitude of Sir Thomas Lipton (famous promoter of sailboat races); an event of *Class* so the newspapers would take it as a serious gentleman’s sport. And it worked! They opened their jaws when they saw a Sterling Silver Revere Ware Bowl, over a foot in diameter, for a trophy.”

It was the first National Aeronautic Association and Fédération Aéronautic Internationale sanctioned hot air balloon race. “I suppose it was the first hot-air balloon race too.”

There were only four entrants. Don Piccard flew in a civilian balloon Dick Keuser had an old brown silicon hot-air balloon that had been built for a research program. Yost flew a Mylar-nylon CIA balloon, and Tracy Barnes had a home-made balloon made out of parachutes. The last participant, Keuser “barely got airborne, went a few feet south and then landed.” The winner was Tracy Barnes.

Piccard calls this first race, the *Jean Piccard Trophy for Thermal Balloons*, one his biggest highlights in life. “Before that, people would say they’d rather be a Fuller Brush or used car salesman,” than a hot-air balloon pilot. This race, “changed ballooning from a carnival stunt and a wacko deal to a competitive sport.” The *Piccard Trophy* was last held in 1971 and Bert and Judy Bigelow were the winners.

Reflecting back to those days at Raven, Piccard thinks the company’s sport balloon division was a cover-up for the military applications of ballooning. “The sport balloon program, which was not believed in by the Raven Industry management, was strictly getting this crazy guy who liked to fly in balloons and make cover. So, when one of these other balloons went down, it would just look like a

sport balloonist.” When the Navy terminated its contract with Raven, the sport balloon program died too. That was in December of 1964.

## Crossing the Channel

Piccard had one last big fling with Raven: a 1963 flight across the English Channel in a hot-air balloon with Ed Yost.

Crossing the Channel was one of the first balloon adventures and it continues to excite and challenge pilots. In 1963, the flight had been made only once from east to west. It was during the inaugural 1906 Gordon Bennett race when Frank Lahm flew from Paris to Whitby, in Yorkshire. Due to wind currents, the preferred route has always begun from the Dover side.

Obviously, flying over open water is not a cake walk. Sea “breezes,” (a.k.a. on-shore and off-shore winds) are actually moving masses of air up to 500 feet thick. They can accelerate prevailing winds in the same direction or cause deceleration and turbulence when they collide together. Sea “breezes” are strong enough to feel like you’re hitting a brick wall and can crush balloons, yet an experienced pilot can use the “breeze” to make 180 degree turns.

Another consideration when flying over open water is what to do if you have to ditch. Water is cold, beside being wet, and total immersion can easily lead to hypothermia and death. An extra intimidating facet of crossing the English Channel, and all other large bodies of water, is that the pilot lacks any sense of speed since there are no visual clues to guide you. For this reason it is easy to think you are standing still. Easy, that is, until you sight land and the feelings of being becalmed are replaced with feelings of being slammed into the land.

Compounding the regular problems of open water crossings is the problem of Channel geography. Though England and France at their closest are a scant 20 miles apart in an east-west direction, the winds sail up channel north-south. Even when aeronauts wait for the most favorable winds, a slight change in direction can be disastrous, blowing balloons far off-course. So, when Piccard and Yost climbed into their gondola in 1963, they were taking an awfully big chance, one that many had not attempted up to that time.

Don Piccard remembers it this way.

"It was Dollfus's idea. He got the sponsors." Piccard had flown with Charles Dollfus in 1950 and, "He knew my family." Over the years they corresponded. "He believed in the sport of ballooning. When it had been demonstrated that a hot-air balloon could stay up for a couple of hours, he said, 'Can you fly 20 miles?' Sure." Dollfus believed, as pilots before him, that crossing the English Channel was the mark of having arrived. "It's a rite of passage."

Piccard was going to do the flight in an S 45 with four tanks. Plans changed. "Suddenly it became a 50 foot balloon and a two man job and the Vice-president of the company is going to come along." An Air Force tanker flew Piccard and Yost from Milwaukee to England, "Loaded everything on board and away we did go!" The two balloonists were designated, "Majors in the Wisconsin National Guard: uniforms, I.D. cards; everything." He pauses and chuckles softly. "All in the national interest, of course."

To hear Piccard talk about it, the Easter Monday crossing was nothing. "So, we end up in England, fly the Channel; they pick us up in Orley [airport, Paris, France] and fly us back." On the return flight, "We never hit five thousand feet all the way from Orley to General Mitchell Field in Milwaukee, across Greenland and northern Canada. Non-stop from Paris to Wisconsin. A hell of a flight."

Calamity followed soon after during a race across the Catalina Channel off the coast of Los Angeles, California.

"Richard Higbie arranged for the Catalina Channel Balloon Race." Piccard brought down the S 45, which had been set up for the English Channel and Yost brought the S 50 which had done the Channel. Barbara Keith brought an S 40. "Made a new S 50 for [Frank] Tallman and [Cliff] Robertson and Semich made two or three balloons."

In his own words, Piccard outlines the tragic finality to this race. "The winds were such that you had to fly low to get to the coast. Yost flew low and he got to the coast. I flew low and hit a tree on the launch field. Just brushed it but it tore the balloon from the nozzle of the balloon all the way to the rip panel; one vertical slit all the way up. I had four tanks and I looked at that and thought, it's a long way

across and the water's awfully cold. So I pulled the rip cord and landed it. Didn't even get over the Channel. Barbara Keith flew high and never got to the coast. Eventually, she landed in the ocean and died of exposure." Sadly, he comments, "She and Yost and I were the only ones with decent Mae Wests."

The original plan was to leave Catalina and whoever got the closest to the mainland would be called the winner. "The NAA said that to be sanctioned, it didn't matter if you landed in the water, but the goal has to be the first person to get across, wins. Yost brought in a big balloon, and I brought in a big balloon, and there were some others, so it was possible to get across."

Since the plan was originally to take off and then land in the channel, pilots had done practice landings in water with boats picking them up. "But I think that contributing to Barbara Keith's death was that the NAA demanded it be a flight to the mainland, rather than who could get closest." That made it sound like you actually could get to the mainland, which she could never do."

Due to poor weather, the NAA officials involved didn't come out to the Island the day before or the day of the race either. "So there was no NAA official there to be in control of anything. The person who was supposed to pick up Barbara Keith quit. She was just out there, with no one knowing she was out there, without a chase group. There was nobody left in charge. Higbie didn't know; he was out there flying the race." Barbara Keith was flying over the ocean and there was only one person supposed to pick her up, a yachtsman by the name of Jack Watts. At this point Piccard's voice gets awfully low and a trace of bitterness comes in. "So there was nobody chasing her and she died."

That was the first fatality in modern hot air ballooning.

Soon thereafter, Piccard left Raven. He had been pressuring the Raven management to move its base of operations from Sioux Falls, North Dakota, to the sunny climes of southern California. "It seemed like the logical spot to set up shop." He says, today, tongue-in-cheek, "They thought there was something suspicious in someone who wanted to leave Sioux Falls in the middle of winter and

move to California!" In the autumn of 1964, the CIA had canceled their contract with Raven and the company evidently saw no reason to continue their sport balloon division so Piccard was out of a job. When that happened, he figured, "Why not?" and made the move to the Sunshine State.

## Hard Times in Sunny Southern California

At the time of Piccard's move, Mark Semich was already making balloons for the civilian market. Shortly after Piccard arrived, Semich moved to Idaho and left the southern California field wide open. However, Semich continued his balloon designing and by 1970, his Semco Balloons would be carrying Malcolm Brighton and two others in a hot-air and helium balloon hybrid that disappeared in a storm off Newfoundland, thirty hours into a west to east traverse of the Atlantic Ocean.

What followed for Piccard after his relocation were some instantaneous hard times. "When I moved out to California, I had a certain grubstake and financial support," he recalls. That grubstake was a small amount of cash from an insurance settlement when he'd totaled his car in Minnesota. "When that was used up, I would be out of the balloon business." Taking the cash, he fixed the car, drove out to California, and found a place to live at a friend of his father's.

Piccard set up shop. He found the technical people to sew nylon for envelopes and make his baskets and burners to his specifications.

The day finally came when Piccard was down to his last two dollars. "That morning I said to myself that when I went to lunch, that would be it; I'd be out of the balloon business and would just have to quit."

With that certain elan that comes from serendipity, the morning mail brought a \$1000 check from Dale Gates. Gates, from the Cleveland Parachute Club had been in contact with Raven, trying to purchase a hot-air balloon. "Raven said we aren't making them any more but if you contact Don Piccard in Newport Beach, California..." The rest, as they say, is history. From that moment on, Don Piccard Balloons had a back log of orders.

Jack O'Neil bought Piccard balloon

number one, actually a ship that Piccard had made for himself. Number two, "went to some guy in France," but it was Number Three, the one that Dale Gates bought, that can be said to be responsible for all that has happened in ballooning ever since. For, without that sale, ballooning would not have achieved the popularity it now enjoys because Don Piccard would have gone out of business and left the sport.

### **Early Success Lead to Later Triumphs**

By 1972 Piccard had incorporated and stepped back in order to let others run the company. "Portis Woolley and Ray Gallagher were the active participants with money from Don Williamson and Lee Smith. It was a Texas corporation, but the same premises were kept in Newport Beach." In 1975, Piccard bought back all the stock.

Then, in 1980, he licensed General Balloon corporation to make Piccard Balloons. That lasted a short time. "They became involved in the movie, *Dune*; they made the worm. That was a more lucrative market and they got out of balloons entirely."

In 1985, he sold his two type certificates to Sidney and Elenor Conn, who formed Galaxy Balloons. They also own The Balloon Works. Type certificates are issued by the FAA and are used to determine the airworthiness of a flying craft. The certifications allow a manufacturer to make repetitive models based upon the initial design and they covers the entire flying system, including testing the burner, drop testing baskets, etc.

Most countries require that a balloon manufacturer submit their product to theoretical and practical approval to insure the designs are airworthy. Hence, a type certificate is a valuable piece of paper, almost like a patent is to an invention or a copyright to an author's work. Given this background, it is easy to understand why a type certificate for a Piccard balloon was something to own. Piccard built a product which was well respected in the sport. Pilots have always known that Piccard fabric wore like iron and lasted forever.

At the Dunstable Gliding Club in 1966, the *Red Dragon*, a Piccard balloon, helped begin the sport of ballooning in Great Britain and the superiority of the Piccard envelope quickly established his

balloons as the best in the field.

### **What Makes Piccard Balloons so Great**

A summary of Piccard Balloons designs would be instructive. Piccard is famous for inventing the concept of the distributed skin load pattern utilizing lobular gores. Piccard's idea of the quick shut-off on the burner itself, so you don't have any burn down of the coils, was also innovative and highlighted his design philosophy of safety which he inherited from his father. When you shut off the burner, it is off. All the fuel in the coils drops back into the tanks.

The top, the lobular gore, of his balloons is lightweight, long-life fabric made of non-conductive materials. In the late seventies, Piccard developed what is now called a "body helmet." It's non-conductive, fire retardant, energy absorbing ABS or Kuidek, a material with a high dielectric constant. Kuidek also has a low temperature invertment, possesses fire retardant characteristics acceptable to the FAA for aircraft interiors. For the terminally hip and trendy, Kuidek also comes in a variety of colors.

All these ideas can be traced back to Jean-Felix and his emphasis on safety. Another safety issue Don Piccard has advanced is the idea of not using aluminum fuel tanks. "When aluminum is involved in a fire," he says, "it softens before the blow-off valve can blow off, resulting in an explosion of the aluminum tanks where steel tanks do not." He's come up with other little safety features too, details that have been apparent and conspicuous in their absence, he says, in balloons offered to the public. "It is apparent by technology that everyone should be doing these things and they're not yet. So that's the philosophy. It will not be a cheap balloon." He adds, "I will not use any names, but I have been terribly disappointed with what has been offered the newcomers to this sport."

With ample success, Don Piccard has not had ample time to rest on his laurels. He's still designing and flying balloons and in the mid-eighties worked on the envelope for the Solo System Ultralight Balloon.

Solo Systems started "after I was out of California," recalls Piccard. He wasn't building any balloons at that time because

of product liability. "It's just not responsible to do something like that without coverage; to protect your customers." Dick Roberts, who'd owned Piccard Balloons for a couple of years, wanted to make a small balloon. "He approached me and asked if I'd make envelopes for it." Piccard agreed and off they went.

Solo Systems was an innovation, not only in design, but also in what it allowed balloon enthusiasts to do: fly without a pilot's license.

### **Why do Sport Balloonists Need a Pilot's License?**

Why do sport balloonists need a pilot's license? "To keep people out of the sport," of course, if you ask Don Piccard.

This is about the only subject that seems to make Don Piccard cranky. He's seen advertisements: "Get a private pilots license for \$1500," and it burns him up. "What do you need it for? Why do you need a pilots license for a balloon? Do you need a license to run a 50 foot motorboat or sailboat?"

For years the FAA would give people a private pilot's license, "just for signing up." That way, if you ever screwed up, "they could take it away from you." He sees it as a waste of time, money, and effort for the federal government to require licenses for sport balloons. "You can ride a 2000 pound horse down the street without a license. You can ride a bicycle without a license. You can take a sailboat, or powerboat with 1000 horsepower; you don't need a license." In disgust, he spits out, "Why should a wicker basket with a nylon bag need a pilot's license?"

Piccard wonders how balloons can fall under the purview of the FAA. "What's the FAA mean? Federal Aviation Administration? What's aviation? Does it have anything to do with balloons? Balloons are part of aviation?" he asks, incredulously and then concludes, "Not in my dictionary." The FAA may have its own definition, but the Webster's New World Dictionary, second college edition, defines "aviation" as, *the art or science of flying airplanes; the development and operation of heavier-than-air craft, including airplanes or piloted or guided rockets ships.* So, Don Piccard has done his homework and has a good point to make.

He does grant, though, that since the FAA regulates radio towers, that, maybe,

balloons should be controlled by the FAA in the same manner as 14 CFR Part 103, ultralight aircraft, of the FAA.

Is there a time when balloon pilots should be required to possess a license? Sure there is: when they are not sport balloonists but when they are flying commercially.

Balloon charter flights tweak Piccard's nose. "I don't think these rides, packing 10 to 15 people in a balloon for a one hour ride is the sport of ballooning. And I don't think it does very much for the sport of ballooning either. I haven't heard of a lot of people who do these charter flights coming back to the ground to buy their own balloons and start flying."

Piccard explains his feelings this way. "Back in the old days, when a guy with an AX 7 or something took two people for a ride, he would sell them on the sport and they'd buy a balloon. But I don't think you see many of the people who get in these cattle cars come back down and buy a balloon and start going into the sport. I don't think it's sport ballooning," he complains. "I'm not interested in it." He isn't against it though and thinks it's fine, "Just as horseback riding and sailboarding is fine." He simply doesn't have an interest in commercial ride operations."

Piccard loves the sport of ballooning and thinks it's a wonderful thing that should be available to people. "And I think Part 103 of the FAA rules and regulations should permit multiple balloons and have a limit of 1000 and not a 150 pounds." He concludes that, "As long as the balloon is being used for sport and not for commercial hire, it should not concern the FAA." If it's safety they are worried about, "That's what the type certificate takes care of."

### **Contributions to Popularizing Sport Ballooning**

On his impressive list of first, perhaps Don Piccard's largest contribution is to popularizing the sport of ballooning. The first great increase in balloonists occurred in the 1970s when additional manufacturers got involved in the business. "I think it was important when Tracy Barnes offered his balloon at a super-low price," says Piccard. "It was a big move," because, "Each person that had a balloon was selling two or three balloons to his neighbor over the course of a year." This exponential growth couldn't last forever and, of course, it didn't.

Why the bubble burst is anyone's guess. One of Don Piccard's guesses has to do with sailboats. Yes; sailboats. "There is a hell of a lot more sky than there is water," he says. "I think we need more valiant competition," more on the order of, "An inspiration

such as the America's Cup." Valiant competition would revitalize the sport of ballooning and put it on the order of other popular spectator sports.


The competitions should be skills oriented, Piccard believes. "The object of having a spot landing competition is to develop the sport, develop the skills, develop the equipment so that you can land your balloon where you want it." Think about it. "The first and most important thing is to be able to land your balloon, and that means not landing in the middle of a tobacco patch or powerline." For competition, "Pilots should be able to land a balloon in a predetermined spot."

Some kind of competition that includes such important functions as getting the balloon inflated and launched needs to be done. These basic tasks, Piccard believes, are "two of the most important functions." If you have competitive launching events, "People will tend to hone and improve their skill and manufacturers will improve the design of their balloons."

Another event he would like to see is an absolute distance race over a set period of time. How far can you fly in an hour? You, the pilot, choose the day and time in order to maximize flying conditions. "I think you would get better press, better credibility and would be doing some really legitimate events that are really flying the balloon and not just working through a three inch thick manual of regulations and protests."

If you probe Don Piccard some more on this topic, he comes up with a story and analogy. "So many times I go out to a balloon race and they say, 'This is like the Indianapolis 500,' and there is a stand where someone is selling tickets for four or five passengers in the balloon in the balloon race! Would Indianapolis be the same if you were driving a station wagon with paying customers in it?"

What would he do about this to change it? "I think that balloon racing would be different if it were solo." In fact, that was a motivating force behind his design of the Ultralight model balloon. "I won't fly in competition with a passenger," Piccard maintains, unless, "a competition requires a partner who is a co-pilot and doing navigating."

Don Piccard was once asked about how he would describe what ballooning was like. He replied with one word: "Unlike." And these days, when it seems something can't be a sport unless it makes lots of noise and goes fast, one can't help but wonder at the truth of that single little word. 

## Don Piccard

by Tom Hamilton

**D**on Piccard's involvement with lighter-than-air aviation began in 1933 when he flew in a gas balloon with his mother, Jeannette Ridlon Piccard. Jeannette would become the first woman to fly to the edge of space with a stratospheric flight to 57,579 feet on October 23, 1934.

Piccard began his own aeronautic career in the U.S. Navy. During World War II he served as a balloon and airship rigger from 1944 to 1946. His practical experience allowed him to do some free balloon instruction before he left the service.

In 1947, while attending the University of Minnesota, Piccard managed to procure a World War II Japanese *FO-GOS* type balloon. These balloons, made from paper and silk, had been used by the Japanese to send incendiary bombs across the Pacific. Piccard added a small basket to the balloon. With the aid of a volunteer ground crew he made a two hour solo flight from downtown Minneapolis. Why two hours? It had to be a two hour flight to receive a pilot's certificate. With that flight Piccard became the first CAA licensed balloon pilot after World War II and the only active licensed pilot in the U.S. at that time.

With the Coupe Gordon Bennett gas balloon race being suspended in 1939 there was little interest in ballooning, outside of research, in the U.S. in the 1950s. Piccard led the bandwagon to reinvigorate interest in ballooning. Piccard founded the Balloon Club of America, with only three other members. Tony Fairbanks from Pennsylvania soon joined and brought in a few more members.

In 1951 Piccard contacted Douglas Leigh of Sky Advertising in New York. Sky Advertising had purchased a large quantity of U.S. military surplus equipment, including several gas balloons. After long negotiations Piccard was able to take possession of the balloons. The surplus equipment included parts of some eleven balloons. Together with Tony Fairbanks they assembled parts for one airworthy balloon. Piccard and Fairbanks made the four hour maiden flight in the club's "new" balloon on November 29, 1952.

The club would fly their balloon three or four times a year. Interest spread and the Balloon Flyers of Akron became the second balloon club in America. Together these two organizations would form the Balloon Federation of America, today the national organization for ballooning in America.

In the 1950's Piccard worked for G.T. Schjeldahl Company which was involved with high altitude research balloons including the ECHO balloons.

Piccard began experimenting with balloon design. In 1957 he flew a Pleiades-Type cluster balloon.



### Highlights

- 1959 First solo in air-plane
- 1978 *Double Eagle II* Atlantic crossing
- 1978 Balloon license
- 1981 *Double Eagle V* Pacific crossing
- 1990-94 *Earthwinds* RTW project
- US Congressional Medal for Aviation Achievement
- French Medal for Aviation Achievement

In 1960 he flew a Mylar envelope balloon.

Piccard continued to push the limits of gas ballooning. In 1960 and 1961 he established new FAI altitude records in class A-1 (now AA-1) and A-4 (now AA-4) rising to 1,140 meters and 10,504 meters respectively. In 1962 Piccard established a world record in the A-2 (now AA-2) rising to a height of 5,409 meters.

In 1960 Piccard learned of the prototype work that Ed Yost at Raven Industries was conducting with a new thermal balloon. He saw the potential for sport ballooning that hot air had over gas. In a 1962 letter to Louis Casey of the National Air and Space Museum Piccard described the potential for this new type of ballooning, "So, whether it is a quiet Sunday afternoon 'picnic' flight or a full blown national race, here we have an economically and ideally suited sporting machine."

Piccard joined Raven Industries in 1962 as manager of the sport balloon program. Quickly, Piccard started to promote hot air ballooning. He organized the first hot air balloon event hosting three balloons had the St. Paul (MN) Winter Carnival in 1962. In 1963 Piccard was "Clerk of Course" for the first U.S. National Hot Air Balloon Championship held in Kalamazoo, Michigan. The event was sanctioned by the National Aeronautic Association.

In 1963 Piccard and Yost became the first to cross the English Channel in a hot air balloon.

These events brought the fledging sport more attention and interest.

When Raven's interest in sport ballooning waned, Piccard struck out on his own. He moved to Southern California and

*Don Piccard continued on next page*

## Don Piccard

opened Don Piccard Balloons, Inc. in 1964. When he first arrived at Raven he made changes in the design of the original *Vulcoon* balloon. Now, with his new company he was free to pursue innovations that would make hot air balloons safer. The use of load tapes, Lobular gore design, lighter weight long life fabric, non-conductive materials were some of his early design features. The use of load tapes in the design and construction of balloons is the single greatest safety factor in hot air balloon history. All of these concepts are continued by today's manufacturers.

In 1965 he flew a Piccard Balloon to a new AX-6 world altitude record of 4,782 meters. In 1973 he set a new distance world record in category AX-3.

In the 1980s and 90s Piccard has been a consultant for new manufacturers. He worked closely with Solo Systems in the 1980s to develop an ultra-light balloon. New innovations in the burner design and venting system has been adopted by other manufacturers. The most notable is the redesign of the parachute top into a rapid deflation valve for final landing. The deflation system uses two lines to actuate the valve and to sleeve the parachute for deflation. The process is reversible and does not require any additional operator assembly. Other manufacturers are now developing their own designs based on Piccard's concept. In innovation of design and safety of flight this is the most significant develop in ballooning since the parachute top in the early 1970s.

Piccard holds numerous patents for balloon innovations. He continues today through Don Piccard Balloons, Inc. to hold a U.S. Type Certificate and still manufacturers balloons.

Piccard has been an active participant in balloon competitions. He first represented the National Aeronautic Association in balloon competitions in 1950 at the Andre Blitz Cup Race in Europe. He won the first Albuquerque Balloon Fiesta (today the world's largest hot air balloon

event) in 1972. He was a participant in the first post World War II Coupe Gordon Bennett gas balloon race in 1979.

Piccard has made numerous first flights that have advanced the state of the art of both gas and hot air ballooning. His flights using various suspension systems and technical advances have included paper balloons, Mylar, and polyethylene balloons.

Piccard has made significant contributions to the volume of information about ballooning. He served in the late 1970s and early 1980s as a volunteer editor for the Balloon Federation of America's monthly newsletter to members. Today he is a contributing editor to *Balloon Life* magazine. In addition he is a frequent contributor of technical and historical information regarding ballooning on the Internet. He is always ready to provide insight and information to others.

Piccard has contributed time, money and artifacts to the National Balloon Museum in Indianola, Iowa and to the Soukup & Thomas International Balloon and Airship Museum in Mitchell, South Dakota. He is currently working with the National Balloon Museum to create a wing to display his extensive family collection on ballooning.

Piccard was award the FAI's highest honor for ballooning in 1962, the Montgolfier Diploma. He is a former National Vice President of the National Aeronautic Association.

Piccard is the dean of American ballooning. Over the past 51 years he has concentrated his enthusiasm and energy in ballooning. He brought back sport gas ballooning to the U.S. He grasped the potential of hot air ballooning as sport aviation. It was his efforts which got the ball rolling for what is today a growing segment of general aviation, a major tourism attraction for the many communities that host balloon events, sight-seeing excursions provided by balloon operators, commercial billboard for companies, and for those who want to fly for fun, the adventure of flight. 