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From Free Flight to Space Flight

NEIL ARMSTRONG
Born: August 5, 1930
Died: August 25, 2012

It all started with model airplanes
Even after stepping on the moon he
still built model airplanes

How many? His 5-year younger brother Dean said "one or two a month".

The ones he liked were hung from the ceiling. (depended on how well they flew)

He built a wind tunnel in the basement. (blew all the fuses)

Student pilots license at age 16.

Fall 1947 enrolled at Purdue University with a 4-year scholarship
Through the US Naval Aviation Program

Joined the Purdue Aeromodel Club, the **AMA**, and flew control line speed.
Enrolled in Aeronautical Engineering
Called up for Korean war
Back to Purdue and completed degree in 1955

Went to work at **NACA** at Lewis Lab in Cleveland
Then to **NACA** High Speed Flight Station where he was a test pilot and flew the X-15.
Test pilots also flew C-47s to transport NASA personnel between laboratories.
(In **NACA** I was project engineer of the B-47 and traveled back and forth between Edwards and Moffett field every week. That's where I met Neil)

OCT. 4, 1957 SPUTNIK

In this time period the space race started and many rockets were being fired to launch orbiting space packages. At **NASA** Ames we were conducting wind tunnel tests on the extreme buffeting encountered in the transonic region. The explosion twice of one particular configuration was called to our attention. My experience with aero-elasticity led me to suspect that a structural mode was involved much like the famous bridge collapse of "galloping gerty" in Tacoma, Wash. In the Ames model shop we built a light-weight model of just the part of the rocket forward of the node of the second bending mode. A hydraulic drive was installed so that we could measure aerodynamic damping. Also, a scaled spring and damper were used for free vibration testing.

1962 Neil chosen for **NASA** astronaut program.

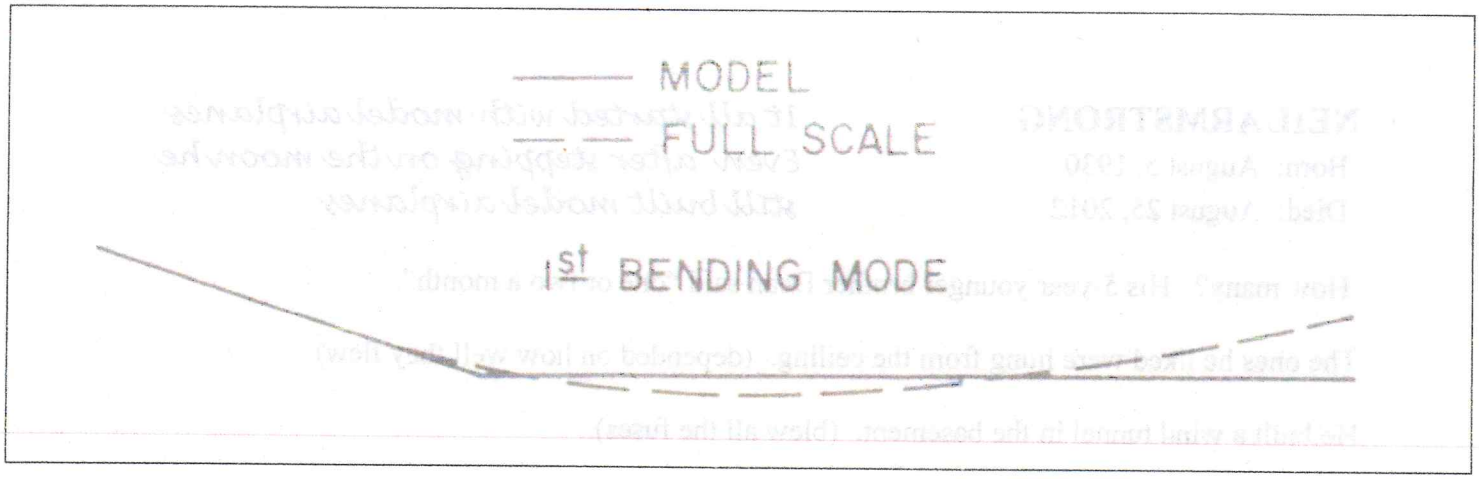
1966 Neil served as command pilot for the Gemini 8 and performed the 1st space docking.

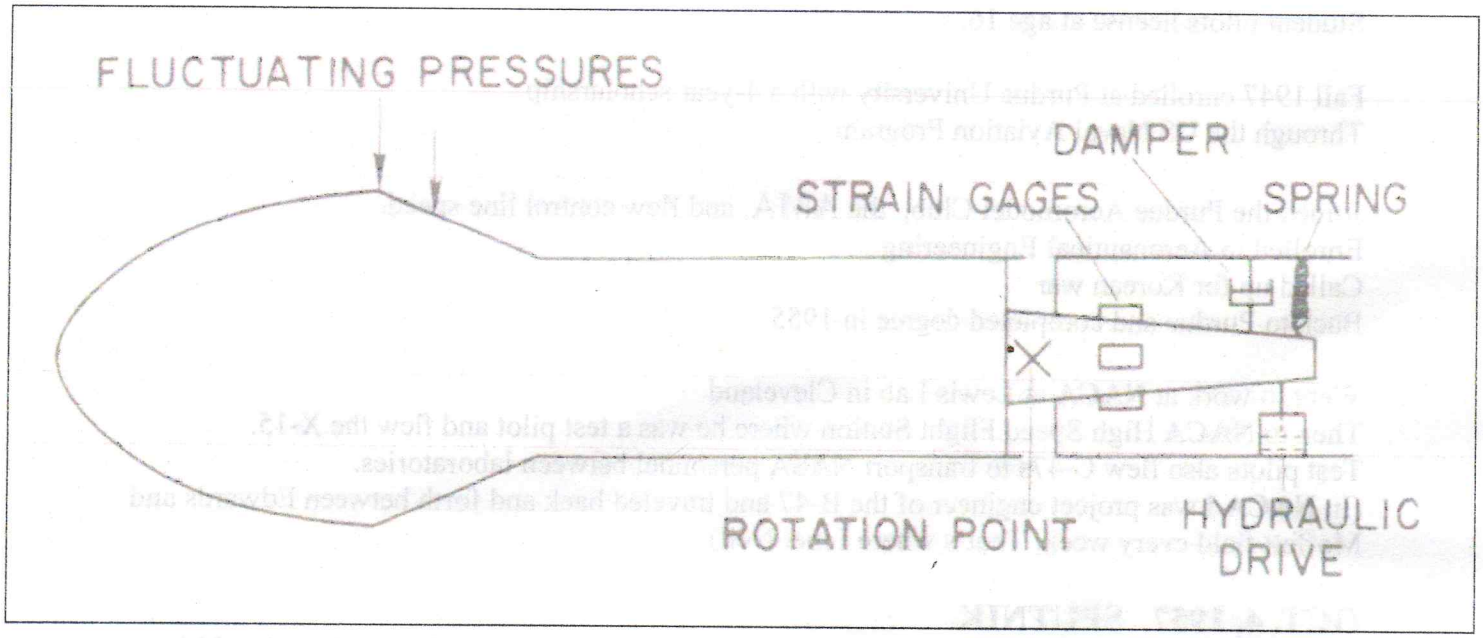
1968..Neil narrowly escapes a Luner Lander Research Vehicle accident.

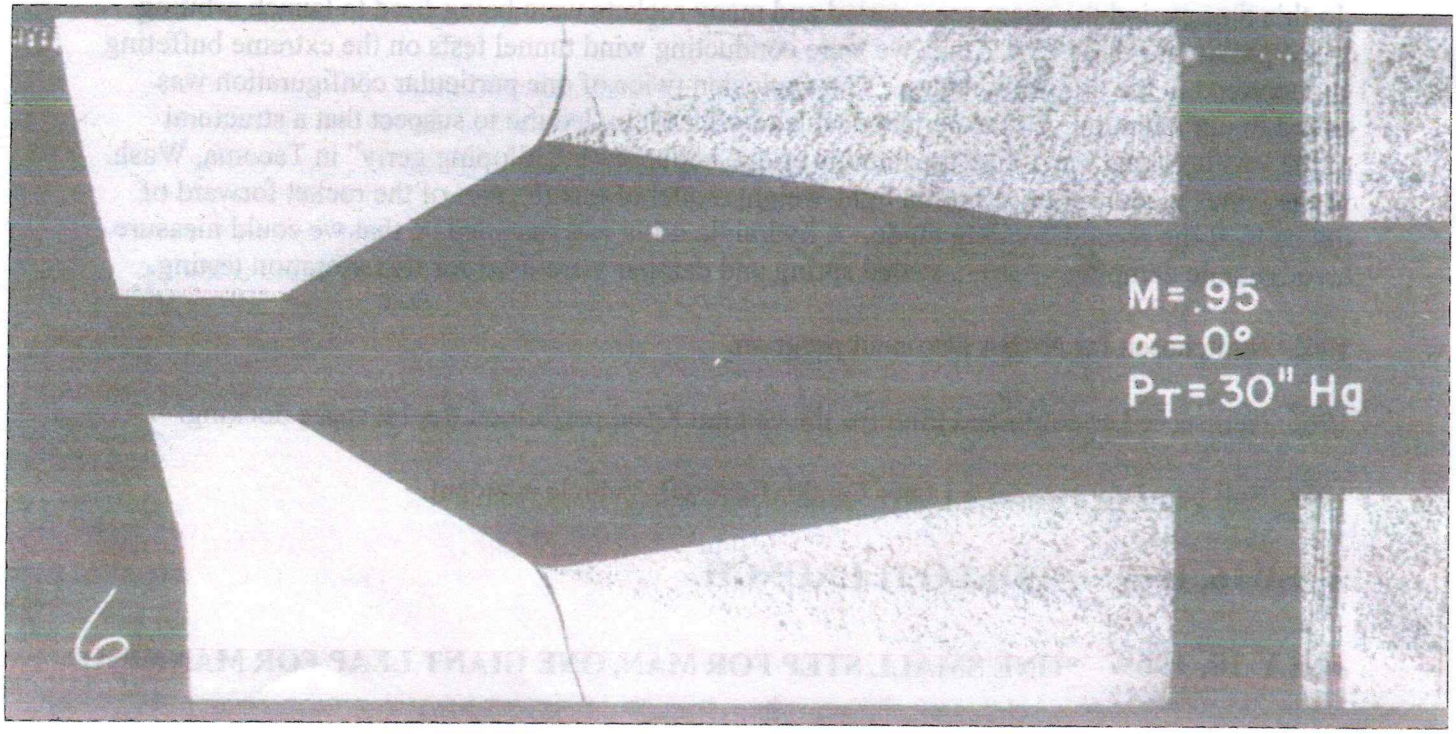
JULY 16, 1969 APOLLO 11 LAUNCH

JULY 20, 1969 "ONE SMALL STEP FOR MAN, ONE GIANT LEAP FOR MANKIND"

PARTIAL MODE MODEL TECHNIQUE

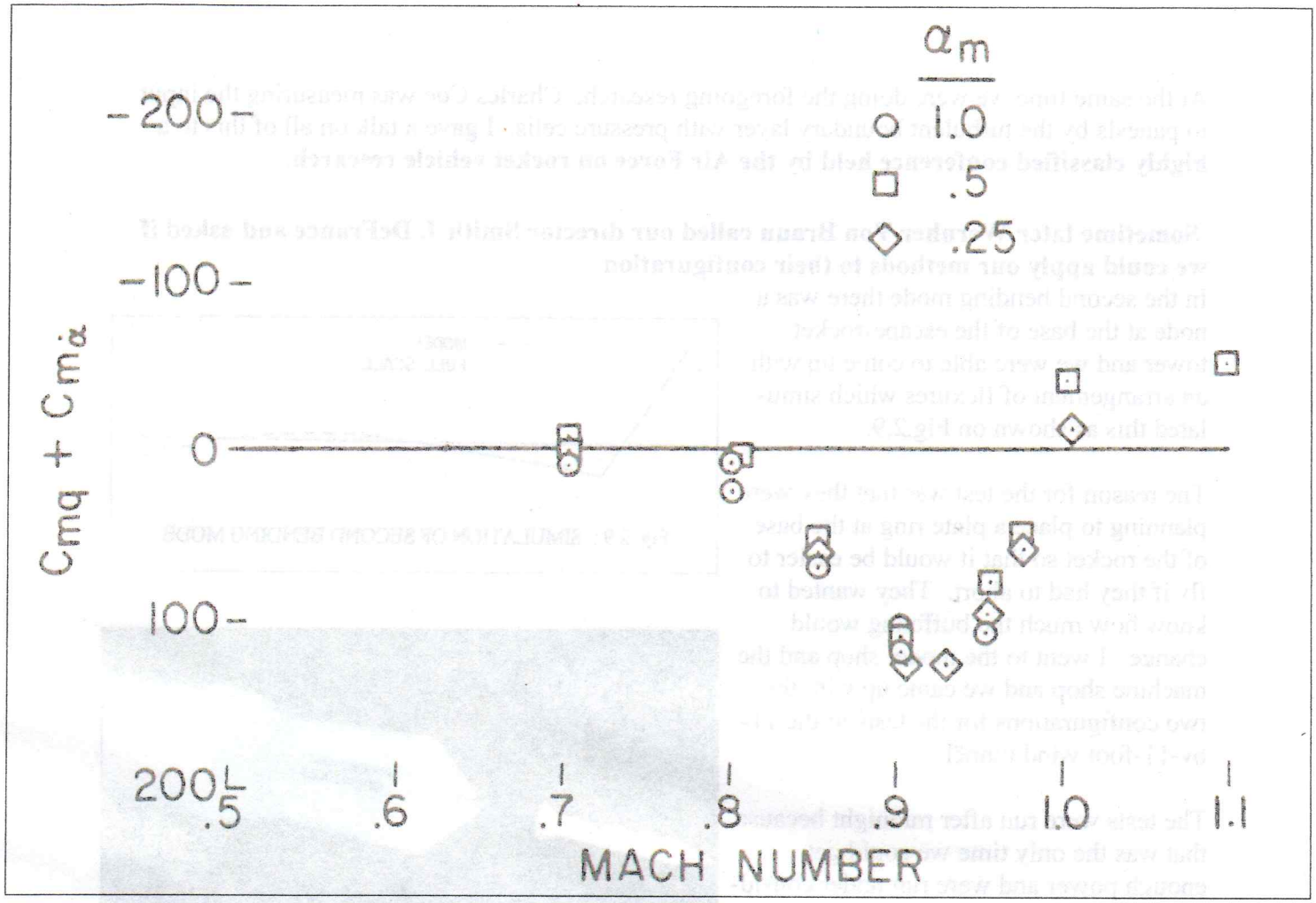






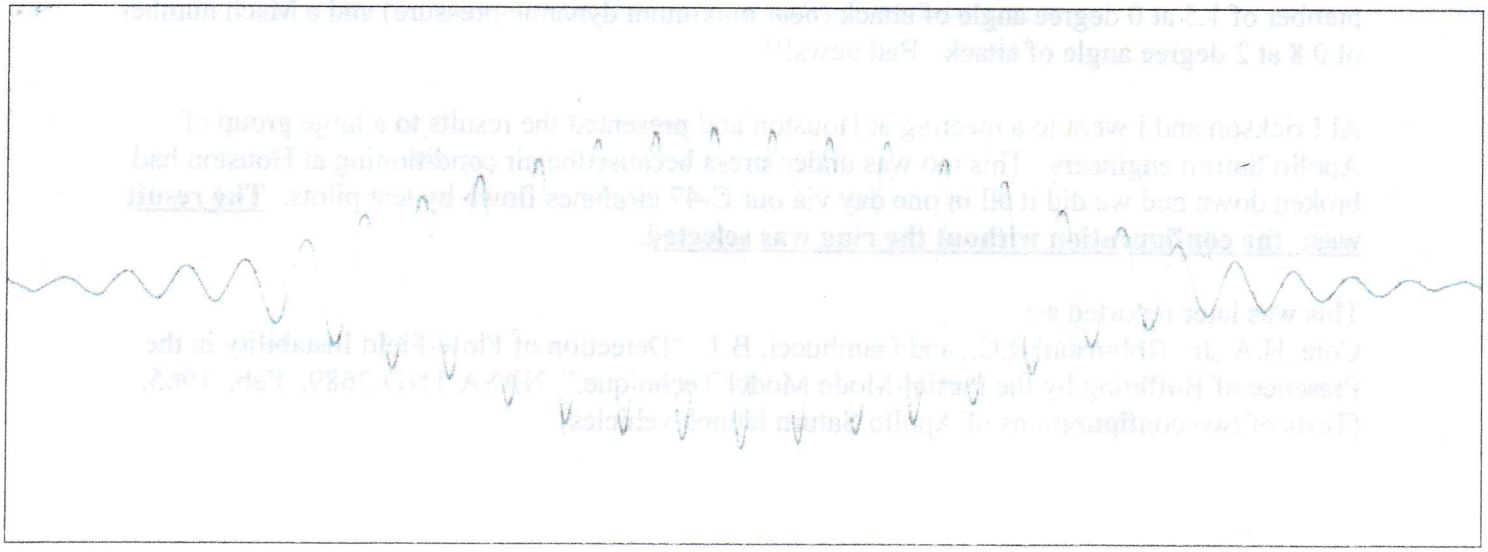
SHADOWGRAPH (IGNORE THE WINDOW FRAME)

AERODYNAMIC DAMPING GOES NEGATIVE AT A MACH NUMBER OF 0.8



IN THE ABOVE TESTS IT WAS FOUND THAT IF THE VEHICLE WAS AT A HIGHER ANGLE OF ATTACK THE FLOW STABILIZED AND THE MODEL COULD BE FLOWN THROGH THE TRANSONIC REGION WITHOUT TROUBLE.

WE TOOK MODEL SUPERSONIC AND HIT EMERGENCY STOP TO SEE WHAT WOULD HAPPEN IN A RAPID TRANSIT. RESULT IS SHOWN BELOW:



At the same time we were doing the foregoing research, Charles Coe was measuring the input to panesls by the turbulent boundary layer with pressure cells. I gave a talk on all of this to a **highly classified conference held by the Air Force on rocket vehicle research**.

Sometime later Wernher Von Braun called our director Smith J. DeFrance and asked if we could apply our methods to their configuration.

In the second bending mode there was a node at the base of the escape-rocket tower and we were able to come up with an arrangement of flexures which simulated this as shown on Fig.2.9.

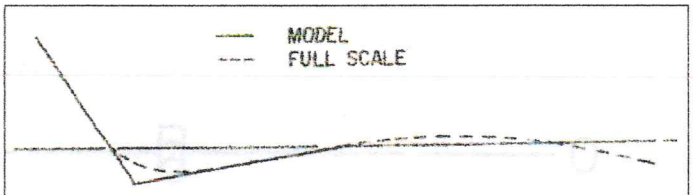


Fig. 2.9 : SIMULATION OF SECOND BENDING MODE

The reason for the test was that they were planning to place a plate ring at the base of the rocket so that it would be easier to fly if they had to abort. They wanted to know how much the buffeting would change. I went to the model shop and the machine shop and we came up with the two configurations for the tests in the 11-by-11-foot wind tunnel

The tests were run after midnight because that was the only time we could get enough power and were run under considerable stress because failure of a model can endanger the compressor.

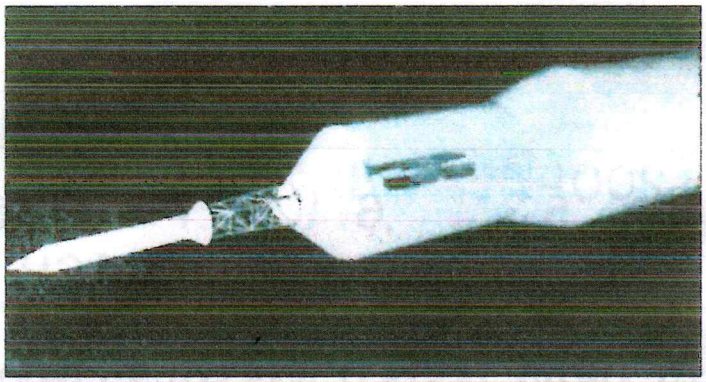


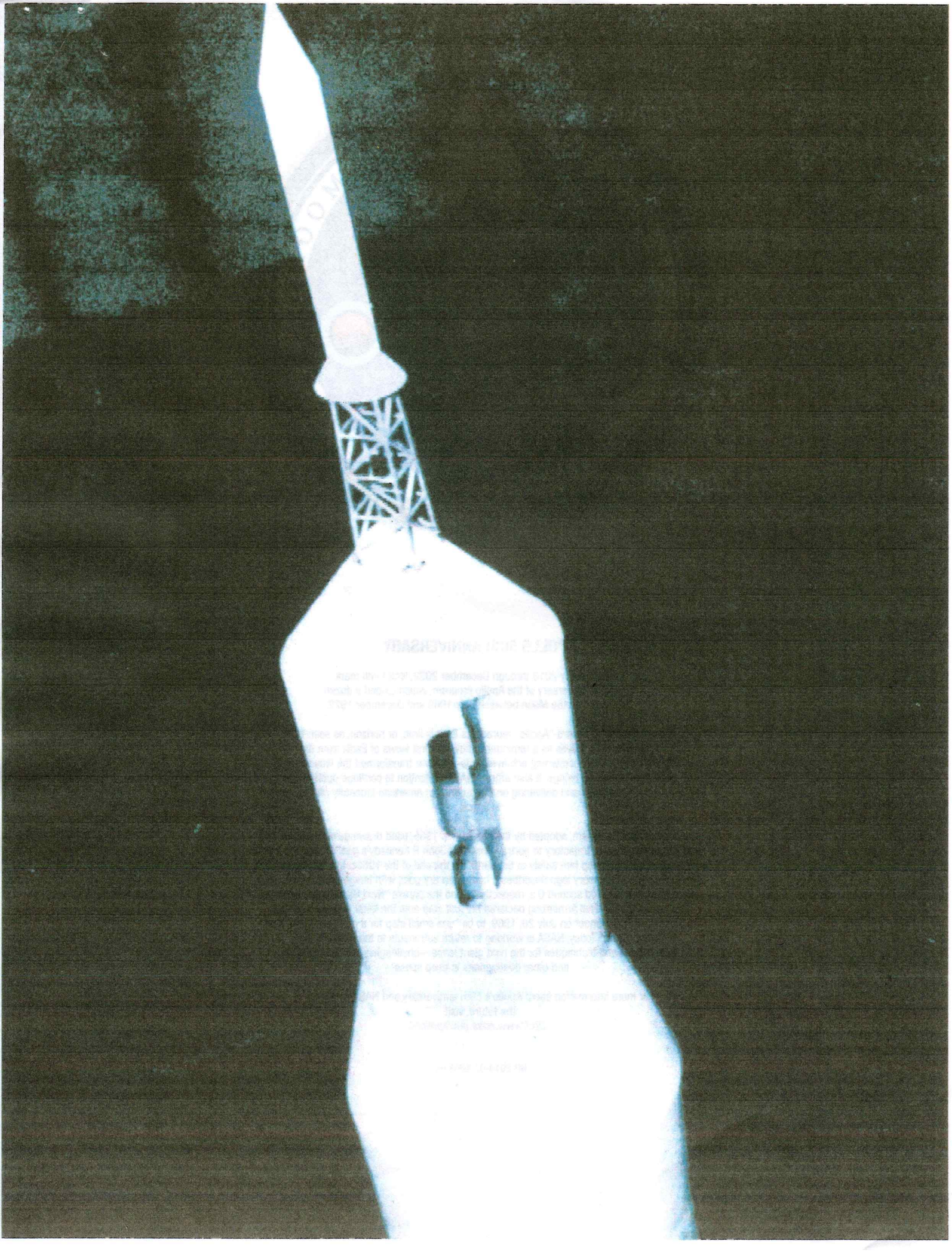
Fig. 2.10: BUFFETING DAMAGE TO APOLLO/SATURN MODEL

We had one failure seen on Fig. 2.10 which indicated high buffeting and another in which the tower broke but did not go down the tunnel.

Spectral analysis was done with a heterodyne type analyzer in which an oscillator swept through the frequency range. With the ring unstable aerodynamic flow fields were indicated at a Mach number of 1.5 at 0 degree angle of attack (near maximum dynamic pressure) and a Mach number of 0.8 at 2 degree angle of attack. Bad news!!!

Al Erickson and I went to a meeting at Houston and presented the results to a large group of Apollo/Saturn engineers. This too was under stress because the air conditioning at Houston had broken down and we did it all in one day via our C-47 airplanes flown by test pilots. **The result was: the configuration without the ring was selected**.

This was later reported as:
Cole, H.A.,Jr., Robinson, R.C., and Gambucci, B.J.: "Detection of Flow-Field Instability in the Presence of Buffeting by the Partial-Mode Model Technique." NASA TND-2689, Feb., 1965. (Tests of two configurations of Apollo/Saturn launch vehicles)



APOLLO 50th ANNIVERSARY

From October 2018 through December 2022, NASA will mark the 50th anniversary of the Apollo program, which landed a dozen Americans on the Moon between July 1969 and December 1972.

The arc through the word "Apollo" represents Earth's limb, or horizon, as seen from a spacecraft. It serves as a reminder of how the first views of Earth from the Moon—one of NASA's crowning achievements—forever transformed the way we see ourselves as human beings. It also affirms NASA's intention to continue pushing the boundaries of knowledge and delivering on the promise of American ingenuity and leadership in space.

The original Apollo emblem, adopted by the program in 1965, used drawings of the Moon and Earth linked by a double trajectory to portray President John F. Kennedy's goal of "putting a man on the moon and returning him safely to the earth" by the end of the 1960s. In a similar fashion, the Apollo 50th anniversary logo describes a contemporary goal, with images of the Moon and Mars filling the first and second O's, respectively, and the phrase "Next Giant Leap" beneath the word "Apollo." Neil Armstrong declared his first step onto the lunar surface from the ladder of the Eagle lander on July 20, 1969, to be "one small step for a man, one giant leap for mankind." Today, NASA is working to return astronauts to the Moon to test technologies and techniques for the next giant leaps—challenging missions to Mars and other destinations in deep space.

For more information about Apollo's 50th anniversary and NASA's plan for the future, visit
http://www.nasa.gov/apollo50

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