DEPARTMENT OF THE AIR FORCE
HQ 1352D PHOTO GROUP (MAC)
LOOKOUT MOUNTAIN AFS
8935 WONDERLAND AVENUE
LOS ANGELES CALIFORNIA 90046

20 FEB 1968

1352(OM)(Mr. Johnson/221)

Transmittal of Final Script TF 6125 "Zoom Flight"

AAVS (AVOPD)
Orlando AFB, FL 32813

Hq USAF (AFXOPXB)
Wash D.C. 20330

1356 Film Lib Sq
8900 S. Broadway
St. Louis, MO 63125

1350 Motion Pic Sq (MCLPD)
Wright-Patterson AFB, OH 45433

Hq AFFTC (FTRD)
ATTN: Major H. J. Royer
Edwards AFB, CA 93523

Hq AFFTC (FTRA)
ATTN: Major J. G. Rider
Edwards AFB, CA 93523

Attached are copies of motion picture script TF 6125, "Zoom Flight" for your information and retention.

FOR THE COMMANDER

ROBERT F. MEGEL
Chief, Motion Picture Services

1 Atch
Script TF 6125
AAVS - 1 cy
Hq USAF - 1 cy
1356th - 3 cys
1350th - 1 cy
AFFTC (FTRD) - 1 cy
AFFTC (FTRA) - 1 cy

DEPARTMENT OF THE AIR FORCE
HQ, 1352d PHOTO GROUP (MAC)
LOOKOUT MOUNTAIN AFS
8935 WONDERLAND AVENUE
LOS ANGELES, CALIFORNIA 90046

TF 6125

"ZOOM FLIGHT"

PRODUCER/DIRECTOR: Alex Johnson

WRITER: Ray Darby

COMMAND REPRESENTATIVE: Harvey J. Royer
Major, USAF
Hq, AFFTC (FTRD)
Edwards AFB, CA 93523

TECHNICAL ADVISOR: James G. Rider
Major, USAF
Hq, AFFTC (FTRA)
Edwards AFB, CA 93523

REQUESTING AGENCY: AFSC

STATUS: 1st Draft, 8 Dec 67
Final Draft, 24 Jan 68

APPROVAL CERTIFICATE

TF 6125

ZOOM FLIGHT

I have read the attached script, scene descriptions and narration, and certify it accurately reflects the policies and procedures of my Command.

COMMAND REPRESENTATIVE:

Harvey J. Royer
Major, USAF
HQ. AFFTC (FTRO)
Edwards AFB, Calif.

DATE: 31 January 1968

I have read the attached script, scene descriptions and narration, and certify it is technically accurate as written.

TECHNICAL ADVISOR:

James G. Rider
Major, USAF
HQ. AFFTC (FTRO)
Edwards AFB, Calif.

TF 6125

AF Form 411

AFS

Zoom Flight

TYPE ITEM REQUESTED

x | Training (TT) | Instructional Film (IF) | Film Report (FR) | Other (Specify)

PRODUCTION SCHEDULE (Select appropriate category)

Category (Maximum 6 months) | x | Category (12 months maximum)

ESTIMATED LENGTH (AFCS determines final length after project research)

x 20 minutes

Train students in procedures involved in preparing for and performing a Zoom Flight mission.

Flight planning, computer programming, simulation practice, instrumentation, & flight.

PUBLIC EXHIBITION | TV CLEARANCE

x | Yes | No

x | Yes | x | No

SEC CLASS AND GROUP CATEGORY (Completed Film)

x | Unclassified | Confidential | Secret

3 | Unclassified | B

15

LOCATIONS

Edwards AFB Calif

Edwards AFB, Calif

SPECIAL CONSIDERATIONS

16 Sep 65

None

TECHNICAL ADVISOR (Individual who is expert in subject matter. Will be commended script and completed production.)

Major James G. Rider, Tele 27-74176
Major Frederick R. Dent, III 27-74176
Capt George E. Thompson, Tele 27-72348
Hq AFFTC (FTRA), Edwards AFB Calif 93523

COMMAND REPRESENTATIVE (Individual responsible for directing comments, support and policy)

Nr. 1

Major Harvey J. Royer, Tele 27-73691

Hq AFFTC (FTRD), Edwards AFB Calif 93523

AF Form 411

#14

Atch 13

EVALUATION OF FILM REQUEST

REQUESTING COMMAND	WORKING TITLE	NUMBER ASSIGNED
AFSC	Zero Flight	TF 6125

FOR AIR PHOTOGRAPHIC AND CHARTING SERVICE USE

1. RECOMMENDED TYPE, CATEGORY AND PRODUCTION METHOD

☐ SFP ☒ TF ☐ FR ☐ CAT. 1 ☐ CAT. 2 ☐ COM CONTRACT

☐ OTHER (Explain in remarks) ☒ CAT. 3 ☒ IN HOUSE

2. RECOMMENDED RUNNING TIME	3. ESTIMATED COST		
	A. SCRIPT	B. PRODUCTION	C. TOTAL
20 minutes	$2,000.00	$9,000.00	$11,000.00

4. ESTIMATED TIME FOR		5. PROPOSED STARTING DATES	
A. SCRIPT PREPARATION	B. PRODUCTION	A. SCRIPT	B. PRODUCTION
2 months	5 months		

6. RECOMMENDED DISTRIBUTION	7. ESTIMATED NUMBER OF PRINTS REQUIRED
Air Force. Recommend clearance for PE, [illegible]	34

8. REMARKS

Recommended clearance for public exhibition is in accordance with attch B, AFSC ltr SOCUP, 20 Oct 66, Subject: Motion Picture Production Requirements, to Hqs USAF (ATXOPXD).

If request approved, we propose to send release print of completed film to SAF-OI for determination of exhibition clearance.

9. PROGRAM DATA	A. ASSIGNED	B. SCHEDULED
FY 68 AFSC Program	0	0
	C. EVALUATED AWAITING APPROVAL 573 reels	D. THIS EVALUATION 2 reels

10. DATE	12. TYPED NAME AND GRADE OF EVALUATING OFFICIAL	13. SIGNATURE
14 Nov 66	[illegible]	
11. OFFICE SYMBOL AVCPD		

FOR HQ USAF USE

14. ☐ APPROVED ☐ DISAPPROVED

15. TYPE	16. CATEGORY	17. TARGET COMPLETION DATE	18. PRODUCTION METHOD

19. SPECIAL INSTRUCTIONS

20. DATE	22. TYPED NAME AND GRADE OF AUTHORIZING OFFICIAL	23. SIGNATURE
21. OFFICE SYMBOL		

AF FORM 412 SEP 64 PREVIOUS EDITIONS OF THIS FORM WILL BE USED UNTIL STOCK IS EXHAUSTED.

Atch 2

PRODUCTION SPECIFICATIONS

TF 6125

"ZOOM FLIGHT"

Security Classification:	a. Script - Unclassified b. Film - Unclassified
Type of Film:	16mm Color
Length:	Estimated 22 minutes
Photography:	a. Live action - 100% b. Sound - 80% off-screen narration - 20% sync-sound
Location:	Edwards AFB, CA
Film Content:	Zoom flight training mission...how it is taught in classroom, through simulation and in actual flight.

Sc. 1 EXT EDWARDS AFB DAY
MS PILOT

Wearing full pressure suit, as he climbs aboard F-104 aircraft.

This man is a U.S. Air Force pilot. There was a time when he was only a pilot...but advancing scientific knowledge and engineering technology have added a new dimension to his career. Today he is a manager. His job... energy manag~~ement.~~

Sc. 2 EXT EDWARDS AFB DAY
ANGLE - F-104

Taking off.

At the Aerospace Research Pilot Training School, Edwards Air Force Base, California, student test ~~experienced~~ pilots are ~~learning to~~ becoming experienced in the narrow envelope between conventional ~~energy managers~~. They are

Sc. 3 EXT EDWARDS AFB DAY
AIR TO AIR SHOT - F-104

In level flight just prior to zoom.

being trained in theory and in practice... on the blackboard and through an aerial maneuver known as...

The aircraft begins zoom, slanting up and away from the camera.

...Zoom Flight.

* in the narrow envelope between conventional and space flight.

SUPERIMPOSE TITLES:

MAIN TITLE: "ZOOM FLIGHT"

DISSOLVE TO:

Sc. 4 INT CLASSROOM DAY
MCU INSTRUCTOR

At blackboard, sketching a typical zoom flight profile, marking X's at critical points.

NARRATOR

Zoom flight is just what the name implies...a high-arcing, ballistic-type trajectory flown by an aircraft, during which the pilot experiences and must cope with many of the principles and problems associated with space operations. It is ~~also~~ a ~~form of~~ very precise energy management demanding ~~great skill and~~ and demanding maneuver knowledge.

Sc. 5 INT CLASSROOM DAY
ESTABLISHING SHOT,
THE STUDENTS

Most in flight suits, as they look, listen, and make notes.

The zoom flight/energy management program is the final phase of the Aerospace Research Pilot School flying curriculum.

Sc. 6 INT CLASSROOM DAY
SYNC SOUND SEQUENCE, PROPOSED BREAKDOWN OF WHICH IS SHOWN ON PAGES 3 and 3A, FOLLOWING.

Sc. 6 (Continued)

a. MS - INSTRUCTOR Speaking to students. TK2 TK1		INSTRUCTOR (SYNC)
b. CU INSTRUCTOR		Now...when you walk out to your aircraft, it contains a certain amount of available energy in the form of fuel. How it will be converted is up to you. You can use it to cruise a long range, to climb to high altitude, to fly fast....or you may even waste it. The many variables associated with optimum energy conversion have already been covered. In Previous Courses.
c. REVERSE ANGLE, STUDENTS		5 Pages. For this discussion, we'll consider you are using good, if not optimum techniques to arrive at a pre-determined altitude, (Potential Energy), at a pre-determined Mach number (Kinetic Energy).
d. MS INSTRUCTOR Traces flight path to pullup point on sketch.		When you achieve these conditions you have stored a specified amount of energy into your aircraft and are now ready to use it or convert it. For our special case, the following relationship exists:
e. CU INSTRUCTOR Writes the following equation on the blackboard:		

$$\text{TOTAL ENERGY} = f\left(W,\ H,\ V,\ \frac{\text{Excess Power}}{\text{Time}},\ \text{wind shear}\right)$$

Sc. 6 (Continued)

f. MS STUDENTS
Making notes.

INSTRUCTOR (SYNC)

If we consider only steady state conditions, that is, no thrust and no drag with steady airspeed and altitude... or better yet, T minus D equals 0... the energy equation may be written:

g. CU INSTRUCTOR
Writing the following equation on the blackboard:

$$E_T = Wh + \tfrac{1}{2}mV_t^2$$

Of course, this equation is valid only in a Newtonian reference system. Therefore it could be used in a moving air mass if the wind velocity were constant throughout...which will not be the case, since wind speed at, say, 35,000 feet may be 80 to 100 knots and at 60,000 feet it may be 5 knots.

h. MS STUDENTS
Making notes.

(ANTICIPATE AND BEGIN TO FADE INSTRUCTOR's VOICE, BRINGING NARRATOR's VOICE OVER IT BEFORE END OF SPEECH)

i. End with MCU of INSTRUCTOR, and ZOOM IN to ECU of figures on the blackboard.

NARRATOR

The complicated formulas learned in the classroom portion of the program establish the principles that govern the flight phase... when the student pilots will be required to fly very precise profiles, similar to those flown in rocket-boosted research vehicles and lifting bodies.

DISSOLVE TO:

Sc. 7	INT FLIGHT SIMULATOR DAY ECU INSTRUMENT PANEL ZOOM BACK to reveal student pilot in simulator. He is "flying" a mission.	As the training proceeds, the students reach a midway point between the classroom and the flight line...where the blackboard figures are converted into readings on an instrument panel. Here they have an opportunity to check out the practical application of the energy management theories...
Sc. 8	INT SIMULATOR ROOM DAY MS SIMULATOR As the student pilot is "flying" it.	...without leaving the ground. Each student spends a minumum of two hours in this NF104 Flight Simulator, which is capable of simulating all parameters of a zoom flight except zero G.
Sc. 9	INT SIMULATOR ROOM DAY MCU PEN RECORDER, OPERATOR The pen recorder is marking the student's flight profile.	A profile of each flight is recorded for later discussion and analysis.
Sc. 10	INT SIMULATOR ROOM DAY MS SIMULATOR As the cockpit is opened, showing the pilot and the instrument layout. The pilot prepares to exit.	This trainer enables the student pilot to fly a realistic zoom maneuver, and to relate the mechanical operation to the energy management concepts he has learned in the classroom.

Sc. 10a INT SIMULATOR ROOM DAY
TWO SHOT - PILOT, TECHNICIAN

Discussing the results of the "flight"

DISSOLVE TO:

Sc. 11 INT PRESSURE SUIT FITTING ROOM DAY
ESTABLISHING SHOT - PILOT, ASSISTANTS

The pilot is being dressed in a full pressure suit.

[Sample with Dent's Reel #1]

During the course of their training, the student pilots will fly zoom missions that top out ~~at~~ about eighty thousand feet. Full pressure suits are required at these altitudes.

Scs 12, 13, 14, 15
INT PRESSURE SUIT FITTING ROOM DAY DIRECTOR'S CHOICE

Fill in sequence on suiting the pilot. End with pilot fully suited, exiting the equipment room or van.

Becoming familiar with the pressure suit...learning to function efficiently while wearing it... these are necessary early steps.

PILOT, ASSISTANTS (SYNC)

PORTION OF THEIR CONVERSATION AND COMMENTS AS THE SUIT IS PUT ON. MENTION ONE OR TWO IMPORTANT POINTS...PERHAPS IMPORTANCE OF PROPER FIT, CLOSURES, ETC.

DISSOLVE TO:

Sc. 16 EXT FLIGHT LINE DAY ANGLE F-104C A maintenance crewman is placing the mounting platform, opening the canopy. The pilot, in pressure suit ENTERS SHOT, climbs into the cockpit.	NARRATOR All zoom flights at the School are made in F-104 aircraft...more or less modified for the purpose. The pilot flies his Suit Evaluation mission in an F-104C model. proper The purpose of this mission is to familiarize him with the pressure suit performance and with his maneuverability and capability in the suit environment.
Sc. 17 EXT RUNWAY DAY PAN SHOT F-104C Taking off.	During the flight, the pilot will go through the preliminary and final phases of the mission, but will not complete the zoom portion.
Sc. 18 EXT EDWARDS AFB DAY AIR TO AIR SHOT - F-104C	
Sc. 19 INT F-104C DAY CU STUDENT PILOT Operating his controls.	Maximum altitude reached...with the cabin unpressurized...is 50,000 to 55,000 feet. Shot of Film
Sc. 20 INT F-104C DAY ECU PILOT Talking on his microphone.	The student is in communication with the pilot of his chase plane.

Sc. 21 EXT EDWARDS AFB DAY
AIR TO AIR SHOT F-104 CHASE PLANE AND STUDENT PILOT AIRCRAFT

Featuring the chase plane, and showing relationship of chase to student aircraft by means of their contrails.

The use of a chase aircraft is an established safety procedure in this and in all succeeding missions. The chase is there to assist in case the zoom pilot encounters an emergency.

End Reel #1

Sc. 22 EXT EDWARDS AFB DAY
AIR TO AIR SHOT
F-104 CHASE PLANE

Sc. 23 INT F-104 CHASE PLANE DAY
CU PILOT

On his radio.

Sc. 24 EXT EDWARDS AFB DAY
PAN SHOT F-104C

Coming in for landing.

DISSOLVE TO:

Sc. 25 INT PRESSURE SUIT FITTING ROOM DAY
MS PILOT, INSTRUCTOR

Their assistants are readying their pressure suits, as the pilot and his instructor with clip board, make last minute check of flight details.

As soon as he has become familiar with all features of the full pressure suit, the student pilot is ready for his first zoom flight. It will be made with an instructor in the back seat, to observe and advise.

Sc. 26 INT PRESSURE SUIT FITTING ROOM DAY
CU PILOT, INSTRUCTOR

Looking over their shoulders at clip board containing sketch of "Zoom Demo" flight. (See attached) The sketch used here should contain additional words describing the 5 phases of the mission, at appropriate places.

Thorough pre-planning is emphasized, especially a knowledge of the many procedures and in-flight checks that must be made at specified intervals during the flight.

Omitted

Sc. 27 INSERT

Sketch of zoom demo flight, on clip board.

DISSOLVE OUT the check notations, leaving only the 5 phases.

The zoom mission is broken down into five distinct phases; acceleration to pullup point...pullup to desired climb angle...tracking the climb angle to desired angle of attack...push over, holding angle of attack constant... and re-entry.

Sc. 28 INT PRESSURE SUIT FITTING ROOM DAY
MS PILOT, INSTRUCTOR

As they set clipboard aside and start dressing in pressure suits.

DISSOLVE TO:

Sc. 29 EXT PARKING STRIP DAY
ESTABLISHING SHOT
PILOT - INSTRUCTOR

Climbing aboard F-104D

Sc. 30 EXT RUNWAY DAY
PAN SHOT F-104D

Taking off.

Sc. 31 EXT EDWARDS AFB DAY
AIR TO AIR SHOT - F-104D

In simple terms, a zoom flight is a climb during which the kenetic energy of an aircraft is converted to potential energy, enabling the aircraft to reach an altitude higher than its steady state ceiling. For maximum success, each phase of the maneuver should be flown exactly as prescribed.

Sc. 32 AIR TO AIR F-104D DAY
ANGLE - PILOT, INSTRUCTOR

Featuring the pilot, as he operates appropriate controls.

A check of the full pressure suit is always one of the first considerations. At thirty to thirty-five thousand feet, the cabin pressure is dumped...

Sc. 32a INSERT
SUIT ALTIMETER
REGISTERING 35.000
(CHAMBER SHOT)

Sc. 32b RIGHT CONSOLE OF
A/C OXYGEN PANEL

Sc. 33 EXT EDWARDS AFB DAY
AIR TO AIR SHOT F-104D

As it goes into afterburner.

...and the aircraft climbs to forty-five thousand feet in afterburner. This altitude is then exchanged for airspeed as the pilot drops back down to start his acceleration run.

Sc. 34 EXT EDWARDS AFB DAY
AIR TO AIR SHOT F-104D

The aircraft pulls away from camera as it accelerates.

In this zoom demonstration flight, pullup is initiated when the indicated Mach No. reaches 2.0, at an altitude of thirty-five to thirty-seven thousand feet.

Sc. 35 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING CAMERA
SHOT F-104D

Approaching pullup speed and point of pull.

Cut film down to eliminate Horizon.

At this point, ideal energy management would call for a condition of maximum specific energy and maximum excess thrust. However, many inconstant factors are involved...such as altitude, temperature, wind, pilot technique and others...making an exact mathematical analysis very difficult.

Sc. 35a INT F-104D DAY
CU PILOT

Operating controls as camera angle indicates pullup.

Sc. 36 INT F-104D DAY
CU INSTRUCTOR

Conversing with pilot via intercom.

The instructor corrects and evaluates the student's performance as the flight proceeds.

(WILD SOUND: INSTRUCTOR CRITIQUE)

Sc. 37 ASKANIA OR TRACKING CAMERA SHOT F-104D

Well into pullup portion of the flight.

Achieving the optimum trajectory during the zoom requires skillful handling of the aircraft. The pre-determined climb angle...in this case, thirty degrees... is attained while slowly increasing the angle of attack until the maximum angle of attack is reached.

Film cropped off
Altimeter reads 45,000
Should be 40,000
on 65

Sc. 38 INT F-104D DAY
CU PILOT

Checking angle of attack indicator.

INSERT APC Gauge or angle of attack indicator, hovering at 6°. (Flightline)

If the pullup is done correctly, at the proper G level for the desired angle of climb, maximum use of excess thrust will be gained and the aircraft will enter the climb angle with maximum specific energy. The climb angle is then held until the planned angle of attack...six degrees in this example... is reached.

Sc. 39 INT F-104D DAY
CU PILOT

Conversing on his radio.

Sc. 40 EXT EDWARDS AFB DAY
ESTABLISHING SHOT
SPACE POSITIONING RADAR CENTER

Each flight is monitored by radar and closed circuit television...

Sc. 41 INT RADAR ROOM DAY
ESTABLISHING SHOT

The radar operator is at his microphone. Technician observing flight profile pen recorder.

...and the pilot is in regular communication with the radar site.

Sc. 42 INT RADAR ROOM DAY
CU OPERATOR

At his mike, talking to the pilot.

OPERATOR

BRIEF SYNC SOUND SEQUENCE, OPERATOR's POV,

AS HE AND PILOT EXCHANGE INFORMATION RE

THE CLIMB ANGLE.

Sc. 43 INT RADAR ROOM DAY
MS PEN RECORDER, TECHNICIAN

The technician observes as the pens trace the flight profile.

Data from the radar is fed into an analog computer which presents its results on a plotting board. This provides an instantaneous picture of the aircraft's position, and is used for pilot guidance and for post-flight analysis.

Sc. 44 INT RADAR ROOM DAY
CU PEN RECORDER CHART

ZOOM IN to ECU of pen as it indicates the aircraft is about to go over the top.

The afterburner and engine are shut down at 63 and 65 K ft respectively to eliminate

DISSOLVE TO:

note

Sc. 45 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING CAMERA
SHOT F-104D

As the power is shut down and the contrails cease.

At sixty thousand feet the afterburner is shut down and the engine are shut down to eliminate the possibility of engine overspeed or overtemperature. This procedure is followed in all zoom missions, but in later flights the afterburner and ~~the~~ engine will be shut down separately and at slightly higher altitudes.

Sc. 46 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING CAMERA
SHOT F-104D

Angled to create impression of aircraft going over the top of zoom.

The aircraft continues over the top without power.

Sc. 47 INT F-104D DAY
ANGLE PILOT, INSTRUCTOR

During this portion of the flight, the pilot and his instructor experience a period of zero G.

Sc. 48 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING CAMERA
SHOT F-104D

In nose down attitude following attainment of peak altitude.

In the re-entry phase, the dive angle is maintained at about the same degree as the climb angle. Although the airspeed builds up slowly to begin with, it can peak out above the airframe limit if proper techniques are not used. The surest way to guarantee that the limiting Mach Number is not exceeded is by holding a sufficient angle of attack and using the drag devices.

Sc. 49 EXT EDWARDS AFB DAY
ASKANIA, TRACKING CAMERA
OR CHASE PLANE SHOT F-104D

On the way down, making a turn.

Since the aircraft is still without power, a turn is made to line it up with the recovery area...a dry lake bed landing strip...in case the engine fails to re-start and a dead stick landing becomes necessary.

Sc. 50 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING
CAMERA SHOT F-104D

Contrails begin as the engine lights up.

The re-start is accomplished at sixty thousand feet. It is significant to note that since the zoom flight program began, there has never been a failure to obtain a re-light.

Sc. 51 INT F-104D DAY
ANGLE PILOT, INSTRUCTOR

The instructor gives a thumbs up gesture.

(SFX: WILD SOUND RADIO CALL - "Sport zoom one---good re-light---bypass flaps closed--")

Sc. 52 EXT EDWARDS AFB DAY
AIR TO AIR SHOT
F-104D, CHASE PLANE

Approaching the landing strip.

Both the chase aircraft and the Space Positioning Radar have monitored the flight from start to finish...the chase aircraft remaining at 35,000 to 40,000 feet during the zoom portion of the flight and picking up the zoom aircraft again as it re-enters.

Sc. 53 EXT PARKING STRIP DAY
PAN SHOT F-104D

Rolling to a stop.
The canopy opens and the pilot and his instructor climb out.

needs to be a clear "D" roll out and taxi in

This zoom mission...the first of many the student will fly... has introduced him to many of the practical aspects of advanced flight. Among these are low dynamic pressure aircraft orientation and recovery, extended periods of low G operation, and re-entry techniques similar to those that apply to spacecraft and the X-15.

DISSOLVE TO:

Sc. 54 MONTAGE, OR SERIES OF QUICK CUTS

a. Pilot entering aircraft.
b. Take off
c. Air to Air shots of aircraft in level flight, in pullup, in climb, going over the top.
d. CU's of pilot operating his controls.

With the demonstration zoom behind him, the pilot begins a series of solo zoom flights. These are almost identical to the demonstration, but vary from a low climb angle of thirty degrees to a maximum of forty-five degrees. The altitude at the top increases with the climb angle.

Sc. 55 EXT HANGAR DAY
RUNBY SHOT NF 104A

A tractor is towing the aircraft out of the hangar, past camera... slowly enough for good observation.

The final two missions in the zoom flight program are flown in a substantially re-configured aircraft designated NF104A. Major external differences include an all-metal nose cone and boom, modified engine air inlets, two-foot wingtip extensions, X-15 type jet reaction controls for yaw, pitch and roll, and a rocket booster engine on the tail.

DISSOLVE TO:

Sc. 56 EXT RUNWAY DAY
RUNBY SHOT NF104A

In approximately same position as preceding shot, as the aircraft is on take off run.

A number of internal changes were also made in producing the NF model... changes mainly designed to increase thrust and improve control.

Sc. 57 EXT EDWARDS AFB DAY
AIR TO AIR SHOT NF 104A

The NF 104A Aerospace Trainer, as this aircraft is known, gives the student pilots an opportunity to gain experience in rocket engine and reaction control operations in addition to the training provided by the F-104C and D models. It can attain altitudes in excess of 100,000 feet, and create approximately ninety seconds of zero G flight.

Sc. 58 EXT EDWARDS AFB DAY
AIR TO AIR SHOT NF 104A

As rocket engine is ignited and the aircraft pulls away.

The rocket engine... ~~a variable thrust~~, multi-start ~~bipropellant~~ engine rated at 6,000 pounds static thrust...is used at carefully calculated intervals to boost acceleration.

Sc. 59 INT NF 104A DAY
CU PILOT

Operating rocket engine control.

Sc. 60 EXT EDWARDS AFB DAY
AIR TO AIR SHOT NF 104A

As the rocket engine is shut down.

END Reel #2

Sc. 61 EXT EDWARDS AFB DAY
ASKANIA OR
TRACKING CAMERA SHOT
NF 104A

Angle indicating pullup.

An eight degree angle of attack and a maximum allowable climb angle of fifty degrees have been established as the ~~most favorable conditions~~ for the zoom portion of the NF 104A mission.

Sc. 62 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING
CAMERA SHOT NF 104A

Steep climb, near peak. The reaction controls are activated, causing intermittent small vapor trails.

When the aircraft nears the apex of the zoom maneuver, and reaches an altitude at which dynamic pressure becomes too low for conventional aerodynamic controls, the reaction controls are activated...either automatically for rate damping or manually for attitude control.

Sc. 63 EXT EDWARDS AFB DAY
ASKANIA OR TRACKING
CAMERA SHOT NF 104A

At push-over...reaction controls operating.

The reaction control system consists of eight hydrogen peroxide reaction motors with 113 pounds of thrust each. They are installed in the nose section and the wing-tip extensions of the aircraft.

Sc. 63a EXT EDWARDS AFB DAY
ASKANIA OR TRACKING
CAMERA SHOT NF 104A

Again, expert handling pays off... for this is a highly sensitive bird, being pushed to the limit of its capabilities.

Sc. 64 INT NF 104A DAY
CU PILOT
Looking ahead thru canopy at skyscape.

Pilot~~s~~ ~~who~~ goes "over the top" at the altitude~~s~~ attained by the NF 104A enjoy~~s~~ he a unique view--a by-product of ~~his~~ his mission... ~~if he can tear his eyes away from his instruments long enough to view it.~~

Sc. 65 EXT SKY DAY

Pilot's-eye view, through cockpit-mounted camera, of sky and horizon as the aircraft noses down.

The sight is familiar ~~but none-the-less beautiful~~ to the astronauts... and now, because of the zoom flight program, to these future-astronauts-in-training at the Aerospace Pilot School.

Sc. 66 EXT EDWARDS AFB DAY
PAN SHOT NF 104A

Approaching landing strip. (If possible, include chase aircraft in the shot.)

But the School brings its pilots down to earth again in short order.

Sc. 67 EXT PARKING STRIP DAY
MS NF 104A

As the pilot climbs out.

Sc. 68 EXT AEROSPACE PILOT SCHOOL DAY
MS TWO PILOTS

In flight suits, as they approach the rear entrance that leads into foyer with coffee bar. They are talking animatedly about the flight.

Sc. 69 INT FOYER OF PILOT SCHOOL DAY
ANGLE AT OUTSIDE ENTRANCE

Two or three other pilots are lounging and drinking coffee as the two men in flight suits enter. The two get coffee, continue their discussion with the traditional post-flight gestures.

Even over coffee, their dialogue is not what the casual onlooker... accustomed to the bull sessions of Club and ready room...would expect.

Sc. 70 INT FOYER OF PILOT
SCHOOL DAY
MCU THE TWO PILOTS

Hashing over the flight.

PILOTS (SYNC)

INSTEAD OF THE USUAL MISSION RE-HASH, THEY ARE DISCUSSING AN INVOLVED MATHEMATICAL EQUATION AFFECTING THE CLIMB OR PUSH-OVER. FADE THEIR VOICES FOR NARRATOR.

NARRATOR

These men are energy managers... taking the long stride between conventional and space flight. We've come a long way since the Jenny and the Sopwith Camel.

FADE OUT.

A. ABBREVIATIONS USED IN MOTION PICTURE SCRIPTS

SC: Scene	MG: Background	FG: Foreground
EXT: Exterior	INT: Interior	LS: Long Shot
MS: Medium Shot	MCU: Medium Close-up	CU: Close-up
ECU: Extreme Close-up	SFX: Sound Effects	

B. GLOSSARY OF TERMS USED IN MOTION PICTURE SCRIPTS

FADE: The optical darkening of a scene to black (Fade Out), or the optical brightening of a scene from black to intensity (Fade In)

Dissolve: An optical transition in which one scene appears to dissolve into another.

Wipe: One scene appears to be wiped away by the succeeding scene. Awipe may be made vertically, diagonally or a variation of this.

Dolly or Truck: A camera movement in which the camera is physically moved toward or away from the object being photographed.

Pan: Movement of the camera in a horizontal plane.

Tilt: Movement of the camera in a vertical plane.

Insert: An extremely close shot of any object such as a letter or a radio tube either held in the hand or placed on a background.

Two Shot: A close camera angle on two people to the exclusion of others in the scene.

Three Shot: As above, except that three people are photographed.

C. SPECIAL TERMINOLOGY USED IN ANIMATION

Pop-on and Pop-off: Sudden appearance or disappearance of an object or character.

Soft Pop-on and Soft Pop-off: As above except object or character appears in faint outline and gradually reaches full definition.

Scratch-on and Scratch-off: Where a line or picture area appears to grow on the screen, or conversely appears to diminish.

Zoom or Truck: The process by which the scene changes from a long shot to a close shot or vice versa.

Pan: Horizontal movement of scene, produced by moving the background.

Sliding Cel: In which a painting or drawing on a transparent material is moved over a background.

Cycle Action: Any piece of action which repeats itself.

Cel Action: Continuous sequential action using a series of drawings.