Chapter 3

OPERATIONS: USAF AEROSPACE RESEARCH PILOT SCHOOL

The USAF Experimental Flight Test Pilot School which moved from Wright-Patterson AFB to Edwards AFB 4 February 1951 as the USAF/AMC Test Pilot School and designated the USAF Experimental Flight Test Pilot School on 1 January 1953[1] was redesignated the USAF Aerospace Research Pilot School 12 October 1961.[2] Effort towards reorienting the school capability had been undertaken by the AFFTC back in 1960,[3] and a school study received favorable attention at Headquarters AFSC during 1960.[4] Indeed, General Bernard A. Schriever, the AFSC Commander, heartily endorsed the proposal, for Major General R. M. Montgomery, the Assistant Vice Chief of Staff, Department of the Air Force advised General Schriever on 31 January 1961 that his recommendation to reorient the school and start a space research pilot course would be considered contingent upon determination of the need for pilots with such training.[5]

Timing of the AFFTC request to up-date the school seemingly was most appropriate. In January 1961 the USAF Air Staff was alerted to work out reorienting details, and the USAF DCS/Operations joined the AFSC staff in solving problems related to acquiring late model aircraft for the school.[6] In particular, the AFFTC wanted F-104's and T-38's for school use with permission to modify them into special configurations to simulate a wide variety of space vehicles.[7] Although the Air Staff acknowledged the requirement, it was their decision that aircraft for the initial class in June

1961 would have to come from AFSC aircraft inventories.[8]

Department of the Air Force approbation was issued on 10 March 1961 to reorient the USAF Experimental Flight Test Pilot School and initiate a space research pilot course.[9] However, long before official sanction had been given the establishment of an aerospace research pilot course the School staff had been feverishly working up a course of instruction for Class Number 1 which would serve as a guide for further classes yet provide the first students with sufficient training to competently teach future students.[10] So important was this effort that Major Thomas U. McElmurry, Chief of the School Operations and Training Division, was assigned as Special Assistant to the School Commandant on 1 January 1961 in order that he might devote full attention to formulating an aerospace research pilot course. Obviously at this early date and until 10 March 1961, these endeavors were in house and only sanctioned by the AFFTC and AFSC. Nevertheless it paid off, and the first class of the aerospace research pilot course began officially on 5 June 1961.[11]

There now followed a Department of the Air Force letter notifying all commands that the USAF Flight Test Pilot School (USAF Experimental Flight Test Pilot School) would be renamed the USAF Aerospace Research Pilot School as soon as Air Force Regulation 53-19 could be revised.[12] On 12 October 1961, the Secretary of the Air Force officially redesignated the School.[13]

Headquarters USAF established school policy on 12 October 1961 by publishing a new AFR 53-19, USAF Aerospace Research Pilot

School. Responsibility for operation of the school was vested in the AFSC commander who in turn delegated that responsibility to the AFFTC commander.[14]

Redesignation of the school did not alter the quasi-official organization as established on 5 June 1961 with introduction of Class #1, Aerospace Research Pilot Course.[15] Under that reorganization, the school headed by a commandant comprised three operating divisions--Experimental Flight Test Pilot Division, Aerospace Research Pilot Division, and the Support Division. Added after redesignation were an interim Administrative Division and an interim Training Research and Development Division (interim pending official approval). It was the function of the latter Division to act as a project office for design, development, and procurement of special training devices including simulators and modified aircraft.[16]

Along with redesignation the school implemented an annual seven month, eight student aerospace research pilots' course in addition to the long-familiar eight month experimental flight test pilots' course. However, the latter course starting two or three times annually and graduating 48 students per year would be reduced to 32 graduates annually. Instruction was designed to teach up-to-date methods of determining flight characteristics, performance, stability and control, and functional utility of aircraft. Students were also taught techniques necessary to obtain and record information on the serviceability of aircraft installed equipment and component parts. Generally, well-qualified

military pilots were selected to attend the course. But personnel from such organizations as the Army, Navy, allied nations, aircraft contractors, and the Federal Aviation Agency as well as other government agencies were trained at the school.

Curriculum for the aerospace research pilot course paralelled somewhat the instruction provided for the experimental flight test pilot course. But it was considerably more advanced since the primary mission was to train pilots to perform manned space research programs.[17] Students selected to attend this course would be limited to those who had graduated from the experimental test pilot course, the Navy Test Pilot School, or the Empire Test Pilot School in England.

Experimental flight test pilot course graduates were awarded AFSC 1341 for assignment to fill vacancies in AFSC 1344, Experimental Flight Test Officer. Aerospace research pilot course graduates would be awarded AFSC 1344S and assigned as pilots, project officers, or to positions in space development programs or flight test projects.[18]

Expansion of the former USAF Experimental Flight Test Pilot School into the field of training space research pilots was not without its problems. First, a curriculum had to be prepared for the Aerospace Research Pilot Course. Weeks and months of toil were devoted to developing a course which would equip the research pilot graduate to handle spacecraft requirements placed upon him. Under the guidance of Major Richard C. Lathrop, Commandant, the school faculty drew up a program which included such subjects as Newtonian mechanics, thermodynamics, fluid

mechanics, boundary layer control, high speed aerodynamics, heat transfer, dynamics of rarefied gases, Einstein's theory of relativity, meteorology, astronomy, propulsion, orbital mechanics, trajectories, and bioastronautics.[19] Next came the problem associated with acquisition of special training equipment, since the course called for the student to be trained in subgravity, reaction controls that permitted maneuvering in space, stability characteristics of space flight profiles, spacecraft boost, orbital re-entry, orbital rendezvous, and ballistic control. To compound the problem, instructors to teach the new advanced course were not available and simulators were either non-existent or not on hand at the AFFTC.

The instructor problem was somewhat alleviated by initiating Class #1, Aerospace Research Pilot Course, designed to provide the first students with sufficient training to competently teach future classes. Class #1 began on 5 June 1961 with four instructors of the Experimental Flight Test Pilot Course and a test pilot from Flight Test Operations--all graduates of the USAF Experimental Flight Test Pilot School. As planned, at least four of these first students would become Aerospace Research Pilot Course instructors.

Lack of special training equipment for the Aerospace Research Pilot Course was not so easily overcome. The best that could be done for the first class beginning on 5 June and the one class of six to eight students per year thereafter until especially configured aircraft and simulators became available

was to coordinate with other agencies for rental use of their facilities. Arrangements were completed with the University of Michigan for a short course in flight mechanics of space and re-entry vehicles, the Ames Laboratory of NASA at Moffett Field would provide some flight control simulator training, Chance-Vought in Dallas provided use of their space simulator, and the Aeronautical Systems Division would demonstrate stress testing techniques and conduct a course in management and instrumentation.[20]

Obviously these were only interim measures to take up the slack until more permanent action could be taken. Considerable reliance will be placed in use of the F-104 particularly in the early years of the advanced course. (It had been found during the training of pilots for X-15 flights that an F-104 in a "dirty" configuration--landing from altitude with landing gear extended, speed brakes down, and drag chute out to increase aerodynamic drag--was a close simulation of the X-15 during its unpowered portion of flight). But it would take at least a year or two before F-104's could be configured to school requirements (rocket engine and ballistic control augmentation). The same was true of F-106 for variable stability and for variable lift/drag.

To satisfy long range these and other requirements of the new course the school prepared an Engineering Service Project[21] which was approved by AFSC with a 4B priority on 30 November 1961.[22] That approbation authorized procurement of needed

simulators and modifications to aircraft within AFFTC and AFSC resources. But neither simulators nor aircraft modifications would come easy. It would take maximum effort combined with skill and command backing to procure simulators--some not even on the drawing board.[23] The same could be said of aircraft modifications required to configure late model airplanes into the variable stability types needed for space pilot training.[24] The cost would be high, but simulating the hostile environment of outer space in an atmospheric environment was the only feasible means by which the Aerospace Research Pilot Course graduate could become an authority in every field related to his vehicle and space.

Commandant and Faculty[25]

Lieutenant Colonel Robert M. Howe continued as commandant of the school through 31 December. Major Robert S. Buchanan was his special assistant for Aerospace Training pending departure of Major Thomas U. McElmurry when he would become Chief of the Aerospace Research Pilot Division, Major Jones P. Seigler was his Chief for the Experimental Test Pilot Division, and Major Arthur Torosian was his Aerospace Engineer. Captain Edward G. Givens Jr., was also a special assistant to the commandant following his return on 14 October from 18 months temporary duty exchange tour at Point Mugu with the U. S. Navy. Captain Philip E. Neale Jr., was Chief of the Support Division, and Mr. William G. Schweikhard was the commandant's Aero Research Engineer.

Other members of the faculty were Captain Thomas P. Stafford, Chief of the Performance Branch, Captain John H. Ludwig, Chief of the Stability Branch, and instructors Major Frank Borman, Captain

Neil R. Garland, and Captain Francis G. Neubeck. School administrative officer was Second Lieutenant Edward K. Mann.

Assigned personnel by month follows:

	JUL	AUG	SEP	OCT	NOV	DEC
Officers	11	12	12	13	13	13
Airmen	5	4	4	4	5	6
Civilians	3	3	3	4	4	4
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Later in this chapter the reader will note that 12 students graduated on 18 August, 16 students were enrolled in a class which began 28 August, and five personnel were participating in Class #1 of the Aerospace Research Pilot Course. Since those officers in the latter class were all from the AFFTC, they are not shown as students. The one student over the 12 enrolled in July and until 18 August indicates that one of the students for the 28 August class reported in to the AFFTC early.

Operating Expenses

Implementation of AFM 66-1 at Edwards AFB resulted in transfer of three functions--technical inspection, aircraft maintenance, and supply--from the school to the 6515th Maintenance Group in January 1961. Along with transfer of the functions the school lost 24 airmen and 52 civilian spaces which had manned these activities. This reduction in activity coupled with a decline in enrollments reflected in the July through December operating account. Funds expended came to $164,000[26] or one-half as much as any like period. During that time, 12 students graduated, 16

new students enrolled, a special class was conducted for five members of the AFFTC, and considerable planning and preparation went into establishing a capability to implement the new Aerospace Research Pilot Course.

School Aircraft and Flying Hours

With the school effort directed towards modernizing its curriculum, it was only natural that some attention would be devoted to updating its primary training tool, the airplane. School aircraft inventory on 30 June 1961 consisted of three B-57's, one F-86, five T-28's, two F-104's, six T-33's, and one TF-102 or 18 aircraft.[27] Only 15 would remain by 31 December and the five T-28's would be disposed of soon thereafter.

First to go was F-86F USAF S/N 52-4349, the last of the F-86's, to storage at Davis Monthan AFB on 10 July. Next was T-33A USAF S/N 51-8954 removed from use in July and released to Reclamation on 1 September. TF-102A USAF S/N 54-1353 went on the disabled list 27 July after damage and was awaiting disposition. And T-33A USAF S/N 53-5541 was released to Reclamation on 31 October. Against these losses, the school picked up F-104A USAF S/N 56-756 on 27 September from the Air Proving Ground Center.[28]

Hours flown per month were:[29]

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Experimental Test Pilot Course Enrollments

Class 61-C began on 28 August 1961 with the following students: USAF Captains Charles S. Aldrich, Roy S. Dickey, Joe H. Engle, Alvinus P. Johnson, William D. Leng, Frank E. Liethen Jr., James N. McClelland, Robert H. McIntosh, James A. Minish, Edmond R. Ringman, and John N. Sexton. Also, from the Royal Canadian Air Force Flight Lieutenants Denis N. Bailey and Clive P. Loubser, from the Italian Air Force Captains Luigi P. Barbero and Giorgio Santucci, and from the Royal Swedish Air Force First Lieutenant Lars E. Johansson.

Experimental Test Pilot Course Graduates

Class 61-A which began on 3 January 1961 graduated 12 students 18 August with Colonel Charles E. Yeager presenting diplomas and awards. Mr. Thomas E. Edmonds of The Boeing Company received the A. B. Honts Award as the outstanding student and the H. M. Ekeren Award for exceptional flying ability. USAF Major Arthur Torosian received the Empire Test Pilot School academic achievement Award.

Graduates were assigned as follows: Major Torosian, Captain Robert L. Baldwin, and Captain William H. Lawton Jr., to the AFFTC; Captain George M. Knutkowski to the Military Air Transport Service; Captain Robert L. Reagan to the Air Proving Ground Center; Captains George M. Simpson and David D. Young to Air Defense Command; and First Lieutenant Peter W. Odger to Air Force Logistics Command. Thomas E. Edmonds returned to The Boeing Company, Captain Mitsuru Asai went back to the

Japanese Air Force, First Lieutenant Antonius P. Okkerman journeyed back to the Netherlands, and First Lieutenant Edmund E. Schultz returned to the German Air Force.

Aerospace Research Pilot Course Graduates

Class #1 of the Aerospace Research Pilot Course graduated five students on 15 December 1961 to inaugurate a new breed of test pilot--aerospace vehicle test pilot. This class began on 5 June primarily as instructor orientation and to develop a curriculum.

Initially it was scheduled to include four instructors of the Experimental Test Pilot Course, Majors Thomas U. McElmurry, Frank Borman, and Robert S. Buchanan, Mr. William G. Schweikhard, and one AFFTC test pilot, Captain James A. McDivitt. However, Major Buchanan was unable to join the class until 19 September.

Addressing this historic group upon graduation was Major General Russell L. Waldron, Assistant DCS/Personnel, Headquarters USAF. Congratulatory messages were received from Vice President Lyndon B. Johnson in his capacity as Chairman of the National Aeronautics and Space Council, Eugene M. Zuckert, Secretary of the Air Force, General Curtis E. LeMay, USAF Chief of Staff, General Bernard A. Schriever, AFSC Commander, and Brigadier General T. C. Bedwell Jr., Commander of the Aerospace Medical Division (AFSC).

Since the Aerospace Research Pilot Course was a first of its kind, instructors and students were one and the same--they taught each other from extensive research of specific areas, guest lecturers were invited to speak at the school, and field

trips were taken to appropriate facilities for special training and use of simulators. Major Borman, Major Buchanan, and Mr. Schweikhard remained at the school after graduation as instructors for the future Aerospace Research Pilot Courses. Major McElmurry was scheduled to attend the Armed Forces Staff College, and Captain McDivitt returned to the Flight Test Operations Division, Directorate of Flight Test at the AFFTC.[30]

NOTES

1. ARDC GO 18, 12 Feb 1953.

2. AFSC SO G-176, 25 Oct 1961. Appendix E.

3. History of the AFFTC, 1 Jan - 30 Jun 1961, page 157.

4. Ltr, AFFTC (FTT) to ARDC (RDPTS-1), 8 July 1960, Subj: Program for USAF Experimental Flight Test Pilot School. Appendix S, this Volume. The 8 July 1960 proposals were revised by the AFFTC in the fall of 1960 and submitted to ARDC by; Ltr., AFFTC (FTT), 10 Oct 1960, Subj: Revision to "Proposed Program for the USAF Experimental Flight Test Pilot School, 1960-1965. That revision contained also a draft of change suggested for AFR 53-19, USAF Flight Test Pilot School, and reemphasized a prior request to redesignate the school the USAF Aerospace Research Pilot School to reflect its dual training function in aircraft testing and manned space vehicle testing.

5. Ltr., DAF (AFCCS) to HQ ARDC (Lt Gen B. A. Schriever), 31 Jan 1961, Subj: Reorientation of the USAF Experimental Flight Test Pilot School. Appendix N.

6. Ltr., DAF (AFPDC) to HQ ARDC (Maj Gen James Ferguson), 31 Jan 1961, Subj: Reorientation of the USAF Experimental Flight Test Pilot School. Appendix O.

7. Interview by C. V. Eppley with Captain Philip E. Neale Jr., Chief of Training R&D Division, USAF Research Pilot School, 27 Jul 1962.

8. Ltr., DAF (AFPMP-11) to ARDC, 10 Mar 1961, Subj: Reorientation of the USAF Experimental Flight Test School. Appendix P.

9. Ibid.

10. History of the AFFTC, 1 Jan - 30 Jun 1961, page 158.

11. Ibid., page 165.

12. Ltr., DAF (AFPTR-F-P) to all Commands, 4 Aug 1961, Subj: USAF Aerospace Research Pilot School. Appendix Q.

13. Ltr., DAF (AFOMO 677M) to AFSC, 12 Oct 1961, Subj: Redesignation of the USAF Experimental Flight Test Pilot School. Appendix R.

14. AFSC Supplement 1, 18 May 1962, to AFR 53-19.

15. Ltr., USAF Experimental Flight Test Pilot School (FTT) to Historical Division (FTNH), 7 Jul 1961, Subj: Annual Progress Report FY-61.

16. Interview by C.V. Eppley with 1st Lt. Edward K. Mann, Administrative Officer, USAF Aerospace Research Pilot School, 31 Jul 1962. Both the Administrative Division and the Training Research and Development Division would become official on 16 July 1962.

17. Booklet: USAF Aerospace Research Pilot School Curriculum, Edwards AFB, California, page 1. Appendix M.

18. AFR 53-19, 12 Oct 1961.

19. See Appendix M.

20. Fact Sheet: Aerospace Research Pilot Course of the Aerospace Research Pilot School. History of the AFFTC, 1 Jan - 30 Jun 1961, Appendix F.

21. Engineering Service Project Card, Updating Technical Facilities and Capabilities of the Aerospace Research Pilot School, 20 November 1961.

22. Ltr., AFSC (SCSNG-Z) to AFFTC (FTT), 30 November 1961, Subj: Proposed Engineering Service Project, "Updating Technical Facilities and Capabilities of the Aerospace Research Pilot School." Appendix T.

23. Ibid., par 2, page 5.

24. Ibid., pages 8-14.

25. Extracted by the author from records kept by the USAF Aerospace Research Pilot School Commandant.

26. Data furnished by Loree Kountz, Chief of the Expense Section, DCS/Comptroller, AFFTC.

27. Hist of the AFFTC, 1 Jan - 30 Jan 1961, page 163.

28. Extracted by author from the AFFTC aircraft and project Cross Reference Charts, AFFTC Aircraft Inventory, published between 1 Jul - 31 Dec 1961 by the AFFTC Aircraft Requirement Branch, DCS/Plans & Operations.

29. Hist of the USAF Experimental Flight Test Pilot School, monthly, 1 Jul - 31 Dec 1961.

30. Interview by C. V. Eppley with 1st Lt. Edward K. Mann, Administrative Officer, USAF Aerospace Research Pilot School, 4 Sep 1962.

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Aerospace Research Pilot Course Graduates

Class #1 of the Aerospace Research Pilot Course graduated five students on 15 December 1961 to inaugurate a new breed of test pilot--aerospace vehicle test pilot. This class began on 5 June primarily as instructor orientation and to develop a curriculum.

Initially it was scheduled to include four instructors of the Experimental Test Pilot Course, Majors Thomas U. McElmurry, Frank Borman, and Robert S. Buchanan, Mr. William G. Schweikhard, and one AFFTC test pilot, Captain James A. McDivitt. However, Major Buchanan was unable to join the class until 19 September.

Addressing this historic group upon graduation was Major General Russell L. Waldron, Assistant DCS/Personnel, Headquarters USAF. Congratulatory messages were received from Vice President Lyndon B. Johnson in his capacity as Chairman of the National Aeronautics and Space Council, Eugene M. Zuckert, Secretary of the Air Force, General Curtis E. LeMay, USAF Chief of Staff, General Bernard A. Schriever, AFSC Commander, and Brigadier General T. C. Bedwell Jr., Commander of the Aerospace Medical Division (AFSC).

Since the Aerospace Research Pilot Course was a first of its kind, instructors and students were one and the same--they taught each other from extensive research of specific areas, guest lecturers were invited to speak at the school, and field

trips were taken to appropriate facilities for special training and use of simulators. Major Borman, Major Buchanan, and Mr. Schweikhard remained at the school after graduation as instructors for the future Aerospace Research Pilot Courses. Major McElmurry was scheduled to attend the Armed Forces Staff College, and Captain McDivitt returned to the Flight Test Operations Division, Directorate of Flight Test at the AFFTC.[30]

Chapter 3

USAF Aerospace Research Pilot School

There was no change in the mission of the USAF Aerospace Research Pilot School (ARPS) from that which was stated in the previous historical report (page 90); and there was no change in the requirements of the organizations responsible for the school's operations. Headquarters United States Air Force continued to establish the school's policies; Headquarters Air Force Systems Command continued to supervise the operation, and Headquarters Air Force Flight Test Center continued to be responsible for the operation of the school.

Changes in the school's organization, and in the command section were, however, implemented during this reporting period. The school's commandant, Colonel Charles E. Yeager, was transferred to Clark Air Base, Philippines, 11 July 1966 and his successor was Colonel Robert S. Buchanan. The deputy commandant of ARPS, Lt Colonel Austin A. Julian, was transferred to the Operations Division of the Plans and Requirements Office, 11 July, and his place was taken by Lt Colonel George D. Hendrix. One month prior to the end of this period, Colonel Eugene P. Deatrick Jr., replaced Colonel Buchanan as the ARPS commandant.

The new organization for ARPS provided for four divisions; Academics, Operations, Simulation, and Training, Research and Development. All divisions except the latter were provided with three branches; Academics Division branches included; Experimental Test Pilot, Aerospace Research Pilot and MOL (Manned Orbiting Laboratory). The three branches of the Operations Division

were; Experimental Test Pilot, Aerospace Research Pilot, and Scheduling and Records. For the Simulation Division the three branches were; Aircraft, Space and Engineering. The organizational changes became effective 11 July 1966.[1]

The program of updating technical facilities and capabilities for the school continued through FY 1967, and it appeared that some of the "active tasks" as they were called, would be around for some time. This program was covered by Project Directive 62-39, and was assigned line item code 9279. As of the close of this reporting period, there were nine active tasks, including:[2]

1. Static Space Flight Simulator
2. NF-104 with Rocket Engine and Ballistic Control
3. Variable Stability F-106B
4. Space Trainer Study
5. F-104 Zoom Modification
6. F-104 Side-Stick Controller Modification
7. V/STOL Pilot Training
8. Lifting Body Trainers
9. T-38 Variable Dynamics Trainer

There was some action in most of these tasks during FY 1967; the highlights of such actions will be recounted in the numerical sequence of the above listing.

The T-27 Space Flight Simulator was accepted prior to this reporting period except for the Mission Effects Projector (MEP). The MEP was received and installed during September 1966, however there was trouble with the display. During June 1967, the Farrand Optical Company, Inc., submitted a proposal to correct the display. Prior to 30 June 1967, the Procurement Office was negotiating a contract for this work using FY 1967 funds. A maintenance contract for the T-27 was negotiated for a two-year period beginning 1 July 1967.

Two NF-104A aircraft were in the Rocket Engine and Ballistic Control Task, the serial numbers were 57-760 and 57-767. Following a functional check flight, aircraft 760 was released for flight; the Class II modification to reduce susceptibility to contamination was completed but the rocket engine had not been ground fired for an acceptance check. During June 1967, the aircraft was down for instrumentation calibration and was expected to be returned to in-commission status by early July.

Aircraft 767 successfully completed ground and in-flight checks of the contamination susceptibility modification. One low altitude zoom flight for a cockpit pressurization check was flown, also one normal zoom flight. The aircraft was out of commission the last few days of June but was expected to resume flights 3 July 1967.

The two aircraft being modified for variable stability trainers were F-106Bs, serial numbers 52-2519 and 52-2529. A progress review meeting was held at the Martin Company, Baltimore, Maryland, during June with ARPS and San Antonio Air Material Area (SAAMA) representatives attending. This program was on schedule and overrun funding of the program was approved by SAAMA.

A qualitative operational requirements (QOR) for a space trainer similar to the X-15 was established in 1961. This requirement was still at Headquarters USAF for staffing.

For the F-104 Zoom Modification, a maintenance schedule was established to de-modify the school's F-104As and install T. O. 913 on the F-104Cs. Class II modifications to install test instrumentation was being accomplished concurrently.

The F-104 Side-Stick Controller Modification objective was to develop and evaluate side-stick for the school and provide student training. A request for proposals (RFP) was released to eight companies 7 June 1967. The proposals were due to be received 5 July 1967 with a contract expected to be awarded late in August.

A new contract for the side-stick controller was made necessary when the Douglas Aircraft Company defaulted, during May 1967, on a contract previously awarded for this modification.

A program change plan (PCP) for a V/STOL trainer was approved by Headquarters AFSC during the last half of FY 1966 and forwarded to Headquarters USAF. USAF indicated the requirement of ARPS might be associated with the Flight Dynamics Laboratory requirement for a research vehicle to support the Lab's program. A representative of the school was investigating that possibility while at Wright-Patterson AFB, Ohio, during the week of 26 June 1967.

The objective for the requirement for lifting body trainers was to provide experience to ARPS students in lifting body vehicles. It was proposed that two trainers be provided ARPS for this purpose. The QOR was submitted to Headquarters AFSC during May 1965 in support of this task.

A T-38 Variable Stability Trainer was required by ARPS to provide student experience on how variable stability and control parameters offset vehicle performance and controllability. During November 1966, a purchase request was submitted to have Cornell Laboratory undertake a study of the T-38 for the purpose of providing a system description.[3] The target for a RFP (request for proposal) was August 1968.

The purpose of these tasks, or requirements, was to provide the ARPS with equipment for the training of research test pilots to meet the needs of the Air Force. In other words, to be able to match the pilots with advances being made in aerospace vehicles.

The ARPS had a total of 43 aircraft assigned as of 1 August 1966 (the inventory date nearest the beginning of FY 1967), and 42 aircraft were assigned as of 30 June 1967. While the quantity of aircraft was only one less as of 30 June 1967, there was a considerable difference in the mission, designation and series of the aircraft assigned 30 June. One aircraft, an F-104A, serial number 56-758, was lost when it crashed 22 September 1966. The following list of aircraft shows the mission, designation, series and serial numbers for all vehicles assigned as of 1 August 1966:[4]

M/D/S	Serial Numbers	Total
NB-57E	55-4258, 55-4263, 55-4267	3
NF-101A	53-2422	1
JF-104A	56-750, 56-752, 56-759, 56-826	4
F-104A	56-754*, 56-758**, 56-766	3
NF-104A	56-760	1
F-104B	56-3722, 57-1301	2
JF-104B	57-1304, 57-1307	2
F-104D	57-1319, 57-1333***	2
NF-106B	57-2507, 57-5729	2
OH-13E	51-13793, 51-13809, 51-13841	3
JT-33A	52-9425, 52-9846, 53-5099, 55-4378, 57-549, 57-567, 57-751	7
T-33A	53-5101, 56-3663, 56-3674, 56-3675, 57-609	5
JT-38A	58-5101, 59-1594, 59-1595, 59-1596, 59-1597, 63-8134, 63-8135	7
T-38A	61-808	1

* - listed as an NF-104A in June 67
** - lost 22 Sep 66
*** - listed as an NF-104D in June 67

Following is the ARPS aircraft inventory for 30 June 1967:[5]

M/D/S	Serial Number	Total
NF-101A	53-2432	1
JF-104A	56-750, 56-752, 56-826, 56-754, 56-759	5
NF-104A	56-756, 56-760	2
F-104C	56-912, 56-915, 56-919, 56-922, 57-930, 56-933, 56-934	7
F-104D	57-1319, 57-1320, 57-1321, 57-1322, 57-1327	5
JF-104D	57-1333	1
NF-106B	47-2519, 57-5729	2
OH-13E	51-13793, 51-13809, 51-13841	3
JT-33A	52-9425, 52-9846, 53-5099, 55-4378, 56-3633, 57-549, 57-567, 57-751	8
T-33A	53-5101	1
JT-38A	58-1195, 59-1594, 59-1595, 59-1596, 59-1597, 63-8134, 63-8135	7

Hours flown by ARPS students and instructors for training during FY 1967 totaled 9,594; this figure is slightly in excess of the 9,549 hours reported by the Aircraft Allocations Branch of the Plans and Requirements Office. Using the ARPS reported number of flying hours for training, the percentage of hours used was 94.12 per cent of the 10,193 hours allocated. The hours, by quarters, reported by ARPS and those reported by Aircraft Allocations are shown below:

	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun
ARPS Report[6]	2,393	2,223	2,286	2,592
A/C Allocations Report[7]	2,401	2,193	2,362	2,593

There was no change in the ARPS training curriculum during this period, however glider training was approved in June 1967, and will be added to the training.

A former ARPS graduate and school instructor, and another instructor during a part of this reporting period, were killed in separate aircraft accidents during the first half of FY 1967. Major Frank E. Liethen, graduate

with ARPS Class 61-C, was killed while performing maneuvers (while in training) with the USAF Aerial Demonstration Squadron (Thunderbirds) 12 October 1966 near Nellis AFB, Nevada. Major David A. Tittle, an instructor at ARPS, was killed in the crash of the Ryan XV-5 experimental V/STOL aircraft 5 October 1966 at Edwards AFB.

Commenting on the death of Major Tittle on the floor of the United States Senate, Senator Howard W. Cannon of Nevada, made the following remarks:[8]

> *Mr President, yesterday, in the crash of a vertical take-off aircraft during a test flight at the U. S. Air Force Flight Test Center at Edwards Air Force Base, Calif., the Nation lost a fine officer and a great test pilot, and I lost a good friend. Major David H. Tittle was a gifted instructor at the aerospace test pilot school at Edwards Air Force Base, where so many of our astronauts have trained. It was there only a few months ago that I participated in simulating discussions with Major Tittle on the aerodynamic characteristics of modern high performance aircraft and the problems that yet need to be resolved. It was there that Major Tittle and I flew together.*
>
> *Major Tittle was a member of that small, elite, fraternity of experimental test pilots who are so dedicated to their challenging and hazardous work. It is because of the calculated risks taken over the years by courageous men like Major Tittle that our Nation is pre-eminent in aerospace achievements.*
>
> *I extend my heartfelt sympathy to Major Tittle's family and friends at their great loss, and I share in their sorrow.*

A Liethen-Tittle Award, to be given to the outstanding graduate of each class, was created; this award replaced the A. B. Honts Award. The first student to receive the Liethen-Tittle Award was Captain David H. Williams of Class 66-A.

Class 66-B began training 8 August 1966, there were 18 students including five who were to complete only Phase I of the course. Of the 13 students scheduled to complete the entire course, 11 were Air Force officers,

and there was one Navy and one Marine officer. Names of all class members at the start of the course are shown below, an astrisk indicates those receiving only Phase I training:

Captain	James A. Abrahamson
*Lieutenant	Jan I. Andersen, Swedish Air Force
Captain	Robert L. Chastain
*Captain	John W. Dettmer, USAF
Captain	Michael D. Hall
Major	Robert T. Herres
*Mr	Ronald S. Hersh, Federal Aviation Administration
Captain	Oleg R. Komarnitsky
Captain	Robert H. Lawrence Jr.
Major	Stanley P. Lewis, U. S. Marine Corps
Captain	George P. Lynch Jr.
Captain	Eldred D. Merkl
*Mr	Donald A. Moor, Federal Aviation Administration
Lieutenant	William R. Needham, U. S. Navy
*Flight Lt	Leonard E. Novakowski, Royal Canadian Air Force
Captain	Donald H. Peterson
Captain	Joseph P. Waters
Captain	Ronald W. Yates

Two students who entered training with Class 66-A 3 January 1966, completed Phase I of the course 22 August 1966; they were Captain Napoleone Bragagnolo of the Italian Air Force, and Mr Freidrick Soos of Germany.

Class 65-C was graduated 2 September 1966, the students included one from the U. S. Marine Corps, one from the U. S. Navy, and 10 from the U. S. Air Force. The A. B. Honts Award was presented to Captain Norman K. Dyson as the outstanding student. Congressman George P. Miller of the 8th Congressional District of California, was the guest speaker for the occasion.

Class members graduated included:

Captain	Thomas J. Davey
Captain	Norman K. Dyson
Captain	Jordon E. Fornell
Major	Warwick W. Glasgow
Captain	James F. Haye
Lt Comdr	Leroy B. Keely, U. S. Navy

Captain	Marren J. Kerzon
Captain	Donald J. Kutyna
Captain	Robert F. Overmeyer, U. S. Marine Corps
Captain	James A. Rider
Captain	Thomas H. Smith
Captain	James T. Strader

Class 66-A was graduated 12 January 1967, with General Bernard A. Schriever (USAF Retired) as the guest speaker. Captain David H. Williams received the Liethen-Tittle Award (first time presented) as the outstanding student. There were two U. S. Navy officers and 11 Air Force officers graduated:

Lieutenant	William R. Casey, U. S. Navy
Captain	George Goodwin
Captain	Alan B. Hale
Captain	James H. Havey Jr.
Major	James F. Humphries
Captain	Donald E. Madonna
Captain	Kenneth J. Mason
Lieutenant	Gary R. Mau, U. S. Navy
Captain	Roy E. Palmer Jr.
Captain	James W. Rhodes Jr.
Captain	Claude H. Segrest
Captain	Larry G. Van Pelt
Captain	David H. Williams Jr.

(NOTE: pictures of gradustes of numbered ARPS classes will be found in the photograph annex, back of this volume.)

The second MOL (Manned Orbiting Laboratory) class began training 2 January 1967; members included:

Captain	Karol J. Bobko
Captain	Robert L. Crippen
Captain	Charles G. Fullerton
Major	Henry W. Hartsfield Jr.
Captain	Robert F. Overmyer

all become astronauts

Training by the members of this second MOL class was completed 5 May 1967. Class 67-A, with 22 members, began training 6 February 1967; four of the beginners were enrolled for only Phase I of the course (indicated by an asterisk). Of the remaining 18 members, two were officers of the U. S. Navy

and 16 were officers of the United States Air Force. The 22-member class was comprised of:

Captain	Edward R. Bracken
Captain	Olin H. Bradley
Captain	Joseph C. Carling
*Mr	William B. Davis Jr., Federal Aviation Admin
Lieutenant	Stuart J. Fitrell, U. S. Navy
Captain	David H. Groark
Captain	Richard E. Johns
Captain	David A. Kerzie
Captain	George E. Luck
Captain	Edward D. McDowell
Lieutenant	Ronald E. McKeown, U. S. Navy
Captain	Richard H. McManigell
Captain	James R. Milner
Captain	Jay N. Mitchell
Captain	Cecil W. Powell
*Mr	Stuart M. Present, Federal Aviation Administration
Captain	Leslie J. Prichard
*Captain	Dieter Stephan, German Air Force
Major	Clarence E. Strobel
Captain	John H. Taylor
Captain	William H. Unsderfer
*Flight Lt	Bertrand J. Wormworth, RCAF

Those entered for only Phase I of Class 66-B completed training 10 March 1967; these individuals were indicated in the previous listing of Class 66-B page 99.

During FY 1967, ARPS reported four officers were reassigned PCS to SEA, and one airman was in SEA on a temporary duty assignment. At the beginning of FY 1967, personnel assigned to the school included 28 officers, 5 airmen, 5 civilians, and 27 students. By 30 June 1967, there were 27 officers, 10 airmen, 3 civilians, and 35 students.

Chapter 3

USAF Aerospace Research Pilot School

Air Force Regulation 53-19, dated 1 May 1963, placed the responsibility for "the operation and supervision of the USAF Aerospace Research Pilot School in accordance with policies established by Headquarters USAF" with the commander of the Air Force Systems Command. The responsibility for the operation of the School was then delegated to the commander of the Air Force Flight Test Center.[1]

The mission of the school was:[2]

> The USAF Aerospace Research Pilot School trains selected officers to monitor or perform flight tests of research, experimental of research, experimental or production type aerospace vehicles. These tests are made to determine flight characteristics performance, stability, and functional utility, and to obtain technical information on serviceability and functioning of installed equipment and component parts.

According to the regulation, to become a student it was necessary to possess a bachelor degree in engineering, a physical science, or mathematics -- be serving on active duty as a pilot in flying status in the grade of major or below; "Apply before his 32d birthday and be available to enter the course before his 33d birthday."[3]

Also to have a minimum of 500 hours as pilot or instructor pilot in (a) Jet or turboprop bomber or transport aircraft (pilot time must be as a pilot in command of the aircraft);[4] (b) Supersonic fighter or training aircraft; (c) Helicopters, or (d) a combination of any of the above.[5]

Training was not limited to officers of the United States Air Force, for the change to AFR 53-19 stated: "Applicants other than Air Force officers

must submit applications to HQ USAF (AFRST), WASH D C 20330, with one copy to AFFTC Edwards, AFB, California ATTN: USAF Aerospace Research Pilot School."

During the period of this report the School's commandant was Lt. Colonel Eugene P. Deatrick Jr., who assumed the position 1 June 1967, he was promoted to Colonel 20 October. Colonel Deatrick was assisted by a deputy commandant, Lt. Colonel George D. Hendrix, and an executive officer, Captain Norman L. Fields, in the operation of the School and its four divisions; Academics, Flight Operations, Simulation, and Training, Research and Development.

Once class of 11 Air Force officers, one U. S. Marine Corps officer and one U. S. Navy officer, was graduated 24 July; this was known as Class 66-B. Members of the class included (class picture in photograph annex):

Major	James A. Abramson
Major	Robert L. Chastain
Captain	Michael D. Hall
Lt. Colonel	Robert T. Herres
Captain	Oleg R. Komarnitsky
Major	Robert M. Lawrence Jr.
Major	Stanley P. Lewis (USMC)
Major	George P. Lynch Jr.
Captain	Eldred D. Merkl
Lieutenant	William R. Needham (USN)
Major	Donald H. Peterson
Major	Joseph P. Waters
Captain	Ronald W. Yates

General James Ferguson, commander, Air Force Systems Command, was the guest speaker for the graduation exercises, and the honor graduate, Captain Merkl, was presented the Liethen-Tittle Award.

Class 67-A was in training during the period of this report, and two civilian students and two students from allied nations completed Phase I

of the course and were graduated 8 September. The four graduates included Messrs. William B. Davis Jr. and Stuart M. Present, Captain Dieter Stephan of the German Air Force, and Flight Lieutenant Bertrand J. Wormworth of the Royal Canadian Air Force.

Twenty-three students began training 1 August as members of Class 67-B. The class was comprised of three civilians, one officer of the German Air Force, one U. S. Navy officer, and one officer of the U. S. Marine Corps, and 18 Air Force officers, as shown below:

Mr.	Donald D. Alexander (FAA)
Captain	Harold W. Blot (USMC)
Captain	Michael A. Clarke
Mr.	Wolfgang Diegnan (Germany)
Major	Alan M. Edwards
Captain	Larry D. Fortner
Captain	Gary A. Hailala
Captain	Bruce J. Hinds Jr.
Mr.	Lawrence A. Herron (FAA)
Captain	Jerry N. Hoblit
Major	Raymond L. Jones
Captain	George W. Larson Jr.
Captain	Robert H. Lilac
Captain	John M. Loh
Major	Wolfram Lueders (GAF)
Captain	George H. Lyddane
Captain	Thomas P. McAtee
Major	Frederick R. Nordin
Captain	Fred H. Porter III
Captain	Byron W. Theurer
Captain	Dean F. Vikan
Captain	Edwin K. Whiting
Lt. Commander	William P. Zirbel (USN)

Captain Hinds was temporarily grounded 15 August for medical reasons and eliminated from Class 67-B, and was held over for the next class, 68-A. Captain Whiting was permanently grounded for medical reasons and eliminate from the class 18 August; he was later assigned to the Base Procurement Office.

The third MOL (Manned Orbital Laboratory) Class began training 2 October. There were four Air Force officers enrolled; all were graduates of Class 66-B. They were:

Major	James A. Abramson
Lt Colonel	Robert T. Herres
Major	Robert H. Lawrence Jr.
Major	Donald H. Peterson

Major Lawrence was killed in an F-104 crash while performing a training mission 8 December. His instructor, Major Harvey J. Royer, chief of the Operations Division, was injured and excused from flying. (see page 41, Chapter 1.)

The Aerospace Research Pilot School (ARPS) had an inventory of 43 aircraft at the close of this reporting period. The type, model and quantity of each are shown below:[6]

Type/Model	Quantity
T-33A	10
T-38A	7
B-57E	3
OH-13E	3
F-104A	5
F-104C	8
F-104D	7

Flying hours for each type and model aircraft for training purposes during the six months were:[7]

Type/Model	Training Hours
T-33A	2,066
T-38A	875
B-57E	361
OH-13E	264
F-104A	384
F-104C	298
F-104D	453
Total Training hours flown	4,701

Six training devices were utilized during this period; the device, hours of training scheduled, and number of training hours used are shown:[8]

Training Device	Hrs. Scheduled	Hours Used
Static Space Simulator	660	660
Static Aircraft Simulator	100	125
T-27 Space Simulator	552	552
Reaction Control Trainer	25	25
TR-10 Analog Computer	100	100
TR-48 Analog Computer	160	250
Totals	1,597	1,712

ARPS students received the required number of flying hours as well as time in the various training devices. The Zoom Program for Class 67-A was most effective, and maintenance received high praise for its efforts which permitted the program to be completed on schedule with a minimum number of aborts.[9]

The start of this reporting period was also the beginning of a new Fiscal Year (FY), and the ARPS did not receive word regarding their submitted budget estimate for FY 1968. Word was received, however, that the School was to operate on a minimum essential requirement basis only. During August it was learned, unofficially, that no significant cuts had been made in the budget forwarded to AFSC.

In September the FY 1968 financial Budget Authorization was received and, except for an $8,000 cut in temporary duty (TDY) funds, all items were accepted. The Budget Authorization for FY 1968 included the following:[10]

Element of Expense Ac't.	Amount
Travel	$ 57,000
Rent & Communications	4,000
Other Services	420,000
Supplies	100,000
Equipment	10,000
	$591,000

Under 'other services' the Budget Authorization stated;[11]

> The following requirements are considered funded within this program:
>
> 564 Space Flight Simulator Maintenance $335,000
> 593 B-26 Stability Service 85,000

By November the FY 1968 budget was approved, but there was a reduction of $39,000 in the contract service area. It was believed this cut might pose problems upon receipt of the two NF-106 VST (variable stability trainer) during the third quarter of FY 1968; $40,000 had been budgeted for maintenance and training on these aircraft. The cut left only $15,000 in the contract service area. The approved budget reflected this cut.[12]

Element of Expense Ac't.	Approved Amount
Travel	$ 57,000
Rent & Communications	4,000
Other Services	381,000
Supplies	100,000
Equipment	10,000
Total	$ 552,000

In addition to the $552,000 approved budget, the School received $43,000 in reimbursements for student training.

There were a few changes made in the ARPS's manpower authorizations during this period. The changes affected rank and shredouts of AFSC's and a change in one AFSC (Air Force Specialty Code). The authorization for three captains was exchanged for three lieutenant colonels to fill the positions of chief of Operations, Academics, and Simulation Divisions. Approved in July, the change became effective 1 October.[13]

Other changes included the conversion of all 2865 (aerospace research flight test officer) spaces to 2865D; the "D" shredout was "prototype aerospace vehicles/shapes." AFSC 68150 (data services specialist) was changed to 27150 (air operations specialist); and 2825A (electronics engineer, general) was changed to 2835C (electronics engineer, guidance and control). These changes became effective 1 August.[13]

Effective 1 October, AFSC 30770 (tele-comm systems control technician) was changed to 30573 (electronics computer technician).[13]

During this period, Major Wayne T. Frye, chief, Academics Division, Captain George E. Thompson, chief, MOL Branch, and SSgt Charles L. Carston, were reassigned to Southeast Asia. Major Walter J. Schob Jr., instructor in the Experimental Test Flight Branch, was reassigned to Clark AB, The Philippines, and Flight Lieutenant John E. Booth, an exchange officer from the RCAF and an instructor pilot, returned to Canada.[14]

As of 31 December the School was assigned 34 officers, 11 enlisted personnel, and four civilians.

Active Tasks for ARPS, listed as Line Item Code 9279, included the following nine items along with the proposed use:[15]

1. Static Space Flight Simulator -- to provide a simulator training capability for ARPS students.

2. NF-104A With Rocket Engine and Ballistic Control -- to provide rocket power and ballistic control augmentation to give experience under zero G conditions and training in energy management and re-entry techniques.

3. F-106B Variable Stability Trainer (VST) -- to train students in the handling characteristics of various space vehicles.

4. Space Trainer Study -- to establish operational requirements for an advanced aerospace trainer.

5. F-104 Zoom Modification -- to reduce hazards to F-104 energy management flights.

6. F-104 Side Stick Controller Modification -- to develop and evaluate side stick for ARPS and provide student training.

7. V/STOL Pilot Training -- to provide students with experience in V/STOL vehicles.

8. Lifting Body Trainers -- to provide experience to students in lifting body vehicles.

9. T-38 Variable Dynamics Trainer -- to give students experience on how various stability and control parameters affect vehicle performance and controlability.

The progress of the various active tasks (LIC 9279) will be covered in the balance of this chapter.[16]

Static Space Flight Simulator:

The Farrand Optical Company, Inc., was approached to correct the deficiencies in the mission flight projector (MFP). A proposal was to have been submitted by the company by 21 August, however a delay until 25 August was requested. Upon receipt of the Farrand proposal it was evaluated and forwarded to procurement for contract negotiations.

Contract negotiations were completed during October, with a starting date on the work of 4 December. The contract was signed in November and the work was underway in December with completion expected by early February.

NF-104 With Rocket Engine and Ballistic Control:

Two aircraft were available for checkout during this period, serial numbers 57-756 and 57-760.

All scheduled flights on #756 were cancelled prior to 10 July due to a leaking rocket turbo pump. A ground abort occurred 10 July due to illumination of the rocket engine fire warning light caused by a hydrogen peroxide (H_2O_2) drop boiloff after drainback along the high point feed line. During H_2O_2 jettison, possible tank contamination was noted; the peroxide system was cleaned and the aircraft was awaiting replacement of the peroxide stand pipe.

Aircraft 760 was in maintenance during July for instrument calibration, and was awaiting parts for T. O. 1F-104-884, Assymetric Flop Detection System. Two FCFs were flown during August. The rocket engine was damaged during a ground run in the rocket shop test cell; a turbo pump bearing failed. Rocket engine spare parts were becoming critical but were receiving top priority from the Center's chief of maintenance.

One functional check flight was made with #756 in August, and an engine overtemp in the after burner and stick kicker operation required corrective action. Two FCFs were flown in September, however the UHF (ultra high frequency) radio reception was unacceptable -- this was a common complaint. A Class II Modification was submitted to install ARC-34 UHF radios in lieu of the existing radios in both aircraft. Other minor discrepancies were noted during the two flights and corrective actions taken.

A gas evolution test was made 6 September with 90 per cent H_2O_2 on the hydrogen peroxide system. The gas evolution rate was above acceptable limits

caused by excessive tank activity with the 90 per cent H_2O_2. The H_2O_2 was drained and the risidual propellant, following a dry GN_2 (gaseous nitrogen) purge, decomposed along the wetted surface of the tank and caused excessive tank temperature build-up, however, no permanent damage was sustained.

The Lockheed representatives were notified of the excessive tank activity in both aircraft (#760 had been tested 29 August). It appeared that an electrochemical deplating process was the best solution to reduce tank activity. This was a proprietary process of Molectrics Inc., of Inglewood, Calif., and had been successfully employed by Rocketdyne, Division of NAA, and NASA-FRC with the X-15, lifting bodies and other craft. By the end of September the ARPS was waiting for a written report on Lockheed's position, and a recommended course of action. Lockheed had refurbished the H_2O_2 tanks on both aircraft in May 1967.

Neither aircraft were flown during October. A spare H_2O_2 tank was used to verify Molectric's Somma Process, and the first test was unsuccessful. A second attempt, however, was successful. As a result of the second test the entire H_2O_2 system from #760 was delivered to Molectrics Inc., to be processed at Lockheed's expense.

Class II Modifications (AFR 68-8) were submitted and approved to incorporate a direct H_2O_2 jettison for the rocket system and a replacement of the UHF radio and "S" band transponder. These modifications corrected all deficiencies noted in the Category II test report on the NF-104.

During November, #763 flew three proficiency flights without rocket operation. The aircraft was then down for maintenance for installation of the above mentioned modifications. Aircraft #760 was returned from Lockheed where the H_2O_2 system had been processed. Tests were performed on both tanks

and the results were very satisfactory. The aircraft then went to maintenance for the same Class II modifications scheduled for #756.

Following modifications on #760, the aircraft was down for a periodic inspection and was expected to be in service by 8 January 1968. Aircraft #765 was down for the processing of its H_2O_2 system by Molectrics, Inc., and for modifications and was not expected to return to service until 21 January.

F-106B Variable Stability Trainer

During the latter half of FY 1966, a contract was awarded to Martin Company of Baltimore, Md., for the modification of the F-106 to be used as a Variable Stability Trainer (VST). It was estimated at that time that the work would require 24 months.[17] (See AFFTC History for FY 1967 for earlier information)

It was informally learned in mid-July that the Martin Company was to inform the AFPRO at Martin-Baltimore 21 July that a second overrun of the contract was pending for about $1.3 million. The project manager at SAAMA (San Antonio Air Materiel Area) prepared an AFSC Form 40 requesting overrun funds and, at a meeting of the USAF D-17 Board 14 August at Hill AFB, Utah, the overrun of approximately $1.3 million was approved. A technical review meeting was held at Martin-Baltimore with representatives of SAAMA and ARPS present.

An amendment to Modification Project 1268 to fund the $1.309 million overrun was approved during September by AFRDQ. This brought the total authorized funds to $4,522,000 and AFRDQ advised SAAMA that no additional funds above the amount authorized were available. Major General Dempster

advised AFLC, 18 September, that contractural commitments on the program must be such as to insure program completion with the overrun which brought the program total to $4,522,251.

During November, the flight test for the #1 aircraft was scheduled for 7 December. Martin had one qualified pilot and another was in training at Loring AFB, Maine. Employes of Reeves Instrument Company, supplier of the airborne computer to Martin, were in strike from 3 to 20 November. The strike was expected to cause a slight delya in acceptance testing of the computer on aircraft #2, and a possible delay in delivery of spares for Martin's flight test program.

The start of flight testing at Martin-Baltimore slipped and was re-scheduled for 22 December. The aircraft was plagued with basic airframe problems; fuel leaks and cockpit pressurization. SAAMA sent an F-106 crew chief to Martin to assist the contractor, and telephone contact between ARPS and Martin was maintained in efforts to solve developing problems. The delivery date for the #1 aircraft was set for 17 April, and 21 May for the #2 aircraft.

Space Study Trainer

A qualitative operational requirement (QOR) was forwarded to USAF in 1961 and was updated annually. It was still at USAF for staffing.

F-104 Zoom Modification

Aircraft 56-912 and 56-919 were reported 95 per cent complete by the end of July with the Zoom Modification. Two more aircraft, 56-922 and 56-930, were about 85 per cent complete. The progress was considered satisfactory.

By August aircraft 912 and 919 were completed and were going through shakedown flights before zooming in September. Aircraft 922 and 930 had an expected completion date of 8 September, and modifications were started on 56-933 and 56-934 22 August.

Class 67-A was the first to utilize the newly modified aircraft for training. By late November, five of the aircraft were completed and another (56-934) was about 95 per cent complete, while the seventh aircraft (57-915) was about 25 per cent complete. The remaining aircraft was not scheduled for the Zoom Modification until Class 67-A completed training early in January. It was reported that the zoom modified F-104C aircraft were holding up very well.

F-104D Side Stick Controller Modification

Before discussing the progress of this program an Impact Statement, forwarded to the AFFTC Budget Office for inclusion with the Monthly C-21 Report to AFSC, will be presented. The statement not only explains the need for the aircraft but gives some background on past procurement actions:

IMPACT STATEMENT OF F-104D SIDE STICK MODIFICATION

The mission of the Aerospace Research Pilot School (ARPS) as identified in AFR 53-19 is to train the future aerospace research pilots both for experimental flight test and aerospace research (space flight) requirements. Significant emphasis has been placed on the manned space flight activities and training as evidenced in the fact that 49 of the nation's 67 astronauts are graduates of ARPS or other test pilot schools. During the aerospace research phase of training, the student is introduced to all aspects of space flight, from theory to airborne simulations. Future aerospace systems employing manned operation and control will use a side stick or hand controller instead of the more conventional center stick found in airplanes. Rocket powered vehicles in particular will require side stick controllers because the accelerations ("g's") are such that the pilot cannot physically maintain control with a center stick.

Consequently the ARPS is required to provide student training in side stick controller operation, response and limitations for all flight regimes such as takeoff, landing, low lift/drag approaches, zero gravity and zoom climbs. Without this training the aerospace research pilot would not be familiar with the "feel" and response of this new controller nor would he be in a position to evaluate what makes a particular controller system good or bad.

The training provided by the ARPS covers theoretical subjects, ground simulation of the anticipated flight characteristics and actual flight experience with the available aeronautical systems but short of orbital flight. The objective of this training is to familiarize the student with as many of the advanced vehicle characteristics as is technically possible. This familiarization will be later put to use during research flight testing when the pilot will be able to evaluate new systems employing side stick controllers, or as a system manager (SPO) when decisions are required concerning control response requirements, characteristics, etc. A past knowledge of side stick operation would be an invaluable asset to the manager evaluating future system requirements and establishing desired characteristics. An example of the benefits of this training is seen in the fact that all past and present X-15 pilots have been ARPS trained and were familiar with the side stick operation and characteristics used in the X-15.

In the past, training in side stick controller operation has been performed in an NF-101A aircraft which includes a variable stability system. Training has been minimum to date because of limited flying hours due to maintenance complexity and the fact that the NF-101A is a single place aircraft. This aircraft is being withdrawn from the ARPS allocation effective not later than September 1967 because the aircraft structure has exceeded its flying hour limitation. This will leave the ARPS without a flying trainer for side stick controller operation or variable stability.

The requirement for a replacement for the NF-101A has been known for a long time. In fact, an identical contract to that presently being sought was initiated by ARPS in May 1965 with the Douglas Aircraft Company. The Douglas contract was firm fixed price in the amount of $207,000. The Douglas Company stopped work on the contract in October 1966 and were subsequently taken into default action. The requirements for the side stick controller modification continues to exist, hence, reprocurement action was initiated in May 1967. Under procurement directives the defaulted contractor (Douglas in this case) is required to pay the reprocurement costs in excess of their original bid ($207,000.00). It is necessary, however, for the Government to fund the reprocurement contractor until the fate of the Douglas legal appeal of the default action is determined in the courts. The legal action in this matter could take several years. The estimated cost of reprocurement is $550,000.00 based on competitive cost estimates

by other contractors at the time of the original side stick controller procurement action. The immediate requirement for $343,000.00 is determined from the difference between the estimated $550,000.00 and the available $207,000.00 of FY 65 funds. If these funds are not available in the very immediate future the Government will have no grounds on which to force the Douglas Company to pay reprocurement costs. The Government, specifically the ARPS and AFSC, would then have to fund the entire line item.

It is imperative that the reprocurement action for the F-104D side stick controller modification proceed immediately to provide the Aerospace Research Pilot School with the tools necessary to enable minimum acceptable training of future aerospace research pilots and astronauts. Additionally, the F-104D side stick will allow familiarization and training of both students and ARPS staff members prior to transition into two (2) NF-106B aircraft with a variable stability flight control system controlled by a side stick controller unit. This will allow more concentrated training effort on variable stability and vehicle dynamics in the limited flying hours available rather than indoctrination into side stick operation as well. The NF-106Bs are presently begin modified under contract with anticipated delivery to ARPS in mid-1968.

Proposals were received from two companies during July in response to the RFP (request for proposal) sent out earlier. They were being evaluated. The technical evaluation of the proposals was difficult because additional data and clarification of items discussed was required. Cost audits of both proposals were underway during August, and contractural negotiations were planned for mid-September. Additional funds in the amount of $343,000 were received from AFSC to aid in funding a reprocurement contract. That amount was the difference between the new estimated cost of the side stick modification, $550,000, and the amount of the defaulted contract, $207,000.

The technical evaluation of contract proposals was forwarded to procurement and competitive negotiations were conducted 19-20 September. It was anticipated that a contractor would be selected during October, and that work would be underway by early January 1968.

During the months of October and November, ARPS and SMAMA (Sacramento Air Materiel Area) personnel were reviewing and researching the contractors list of government furnished equipment to determine the exact availability. Of particular concern were the MAP (Military Assistance Program) parts for the F-104G which were required for the preferred technical approach. The early January contract starting date was still hoped for.

By early December SMAMA indicated that MAP F-104G parts were not in stock. Estimated lead time on one of the major items was 15 months, and this was unacceptable. It appeared, as the year came to an end, that the ARPS would have to choose between (a) Martin's original proposal, (b) accept Lockheed's proposal, or (c) request a revised proposal from Martin to include development of servovalves and actuators not to be found in MAP stock. The design and drawings of the F-104G parts were proprietary to Lockheed. If (b) or (c) were to be the choice, additional funding would be required.

V/STOL Pilot Training

The search for a vehicle for this proposed training was, in reality, what one might call the "shopping stage." ARPS representatives met with the Air Force Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, in July to discuss the potential of ARPS participation in the flight test evaluation of the XV-4B "Hummingbird" V/STOL during 1969-70 at Edwards AFB; and such participation was welcomed. Pending results of the evaluation, ARPS might desire to retain the XV-4B for use as a V/STOL trainer. Only one would be available as the #2 vehicle was allocated to NASA; 1970 would be the earliest available date.

During September, ARPS met with NASA-Ames to discuss their experience with the X-14A V/STOL aircraft. It was learned that additional models of the X-14A suitable for student training were not ha

ARPS continued the search and in October personnel were evaluating the Canadian Aeronautical Research Establishment's variable stability H-13 helicopter as a training tool to provide realistic V/STOL simulation. By November, the UH-1 helicopter was in the picture, however this aircraft would require a modification to provide a variable stability system and an auxiliary thruster before it could satisfy the trainer requirement.

In December, ARPS personnel were investigating the possibility of using the Hawker Harrier to fill its requirement for a V/STOL trainer. The Hawker Harrier was a two-seat version of the XV-6. As the year closed no decision had been made regarding any of the aircraft investigated.

Lifting Body Trainer

A qualitative operational requirement was submitted to AFSC in May 1965 in support of this task.

T-38 Variable Dynamics Trainer

Nonavailability of funds and the desire of the ARPS not to modify the T-38s until a later period, moved the date for this task into the future. A target date of August 1968 was set for request for proposals.

Universal Aircraft Flight Simulator Facility

A requested operational capacity (ROC) was drafted and sent to Plans and Requirements in July for coordination and transmittal to Headquarters AFSC. A conceptual facility study report was approved by AFSC in the amount of $25,000, and a work statement and procurement package was prepared. It was estimated that the study would start in September, and the facility would be included in the ARPS's FY 1970 MCP (Military Construction Program) submital.

During August the conceptual facility study was approved by AFSC and funded in the amount of $35,000. A RFP was issued to industry with proposals due at AFFTC by 5 September. The FY 1970 MCP submital to AFFTC included two items; the Universal Aircraft Flight Simulator Facility (UAFSF) and an Academic wing addition to the ARPS facility. It was proposed that the Academic wing contain two classrooms to accommodate up to 35 studetns each, and one classroom to accommodate up to 20 students, a data reduction and film reading room, and latrine facilities.

Proposals were received from industry during September for a cocceptual facility study were evaluated to define the required equipment and facility. The study contract was expected to be negotiated during October. The AFFTC Facility Utilization Board met in September and established a Center #3 priority for technical facilities for the UAFSF, and a Center #2 priority for support facilities for the Academic wing for submital to AFSC for the FY 1970 MCP.

Conductron-Missouri was selected as the contractor, in October, to perform the conceptual facility study, with a starting date of 16 October. A verbal summary report was to be presented at the Center between 15 and 24 December, with the final report to follow in 30 days. In December it was learned that the rough draft of the final report would not be ready until 5 January 1968. Since there was no price increase, the delay was considered beneficial to the Air Force since it should result in a better quality program.

(Note: information regarding the projects covered in the preceeding pages was extracted and consolidated from monthly status reports, RCS: AFSC-U-78.)

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

On 4 February 1951 prior to relinquishing command of Edwards AFB to the newly created Air Research and Development Command (ARDC), Air Materiel Command (AMC) transferred to Edwards AFB the AMC Flight Test Pilot School which been training selected AMC pilots for several years at Wright Field to perform flight tests on production and experimental aircraft. After the move, the AMC Flight Test Pilot School became the ARDC Experimental Flight Test Pilot School until 1 January 1953 when it became the USAF Experimental Flight Test Pilot School--a designation that reflected the school now accepted applicants on an Air Force-wide basis.[1] Operation of the school remained under control of ARDC, however; an unusual deviation from the accepted practice whereby Air Training Command exclusively operated all Air Force schools.[2] The USAF Experimental Flight Test Pilot School designation endured until 12 October 1961 when the facility became the USAF Aerospace Research Pilot School.[3]

Subsequent to 1961 the school curriculum consisted of two distinct courses --an experimental test pilot course and an aerospace research pilot course--each about seven months long. Students of the experimental test pilot course received training in the latest methods of testing and evaluating aircraft and related aeronautical equipment. Enrollment usually was made up of Air Force pilots, pilots of other services and agencies, pilots of allied nations, and pilots of Air Force contractors. Aerospace research pilot course students

were graduates of an experimental test pilot school selected to train as pilots and project officers for manned space programs.

The two course concept of training following a trial period of two years was consolidated into a one course two phase type training on 1 July 1963 with each phase corresponding to the old two course training. Combining the two former courses compressed the over-all training time from about 16 months to one year; and in many instances, it reduced the permanent change of station per student (some students finished the experimental test pilot course, returned to their home station, and then returned to the school later for the aerospace course). Moreover, when there was a time lapse of any great length between graduation from the experimental test pilot course and entry into the aerospace research pilot course the student had to review certain basic engineering subjects and test flying theory at the beginning of the latter course. Under the single continuous course, training common to both courses had been combined thus eliminating the need for basic review in the aerospace research pilot phase of instruction. Merging the two former courses also enhanced revision of the curriculum to keep it in harmony with the space oriented evolution occurring in Air Force operations and testing. But more than all else, perhaps, the single course by eliminating the time between courses produced an aerospace research pilot younger than one trained in two courses,[4] and this was important in view of the dwindling pool of young test pilots available and qualified for aerospace research pilot training.

Training Facilities and Equipment

Headquarters USAF since May 1962 actively supported Engineering Service Project (ESP) 922A-9060 to update school technical facilities and capabilities.[5] The school under the ESP had received funds for new facilities, obtained additional aircraft, and augmented manpower authorizations as necessary to train annually 36 research pilots for manned space flight[6] and 12 experimental test pilots. Fund-wise, the school received approval to spend more than $10 million for space training aids and equipment to facilitate training.[7] New equipment by 1964 included a variable lift/drag (L/D) F-106A, an interim static simulator and a ballistic control simulator manufactured locally, a static space flight simulator, and three F-104A aircraft augmented with rocket engines and ballistic controls purchased to provide experience under zero gravity conditions and to provide training in energy management and re-entry techniques.[8]

NF-104A Rocket and Ballistic Control Augmented Trainer

Lockheed California Company at a cost of $5,363,322 modified three F-104As to the NF-104A configuration by adding an LR-121-NA-1 rocket engine to each and augmenting the aerodynamic controls with reaction controls for space student training at altitudes in the neighborhood of 120,000 feet. Lockheed also replaced the F-104A vertical tail with a TF-104G vertical tail, replaced the J79-3A engine with a J79-3B, and pressurized the cockpit with nitrogen. Lockheed finished their work in mid-1963 and delivered NF-104A USAF Serial Number 56-760 from Palmdale to the AFFTC on 1 October, USAF S/N 56-672 on 26 October, and USAF S/N 56-756 on 1 November.[9] One of the airplanes went to the Deputy for

Systems Test for a flight test evaluation to determine if the NF-104A had acceptable flying qualities for its design mission and the other two went to the school for instructor checkout.

Only two instructors--Major Robert H. McIntosh and Captain Frank E. Liethen Jr--and the school commandant ever checked out in the NF-104, and none of the three aircraft ever has been used for student training.[10] One of the airplanes (USAF S/N 56-762) at the school crashed to destruction on 10 December 1963 following a zoom maneuver,[11] and the other airplane at the school (USAF S/N 56-760) joined the one in test at the Deputy for Systems Test. Test and evaluation of these airplanes was complete on 16 February 1965 and both airplanes returned to the school inventory for instructor checkout within the limitations now imposed as a result of the long evaluation during flight test.

Several new development items had been added while the NF-104A was in a test status to make it even reasonably safe. Yet it still could not be used as an aerospace trainer unless certain flight restrictions were imposed.[12] In addition, testing thus far proved conclusively that the NF-104A would require an intimate knowledge of the aircraft and its flight characteristics for it was extremely sensitive at high altitudes. Maintenance of the airplane also had become a severe problem now because of the many modifications made to the aircraft and its systems since it had been in test.

Only one of the two NF-104As being used for instructor checkout was still flying at the end of June 1965, for USAF S/N 56-756 received major damage to a wing and the aft under fuselage while returning from a zoom climb maneuver on 18 June when an explosion occurred following a failure in a hydrogen peroxide line leading to a reaction control motor.[13]

T-27 Static Space Simulator

The space flight simulator that began 30 November 1962 under contract to the Link Division, General Precision, at a cost plus incentive fee price of $3,481,000 finally began arriving at the school on 5 October 1964. Contractor development problems associated with the visual system (Mission Effects Projector), computer system, and moving base system, caused some delay in delivery and cost another $1,440,000 as well.[14] Additional overrun on the space flight simulator mission effects projector portion of the visual system was estimated to be as much as another $240,000. Nevertheless, installation of the simulator had progressed sufficiently by 22 December to permit a dedication ceremony in which the Air Force Vice Chief of Staff, General John P. McConnell, officially accepted the T-27 Space Flight Simulator from Link Group President, Mr. Lloyd L. Kelly.[15]

Student training in the $5,500,000 static space simulation facility in a new wing of the school began in February 1965 although the T-27 still lacked the mission effects projector portion of the visual system.[16] The space flight simulator was complete enough now, though, to provide realistic orbital launch, rendezvous, and docking space flight training locally for the first time in almost four years of turning out space pilots, project managers, and space flight consultants. Currently also, investigations were being made to expand the T-27 space flight simulator capability to include simulation of the Manned Orbiting Laboratory (MOL) system Gemini-B vehicle and mission characteristics.[17] About the only significant problem besides the inconvenience of operation without the mission effects projector portion of the visual system to come up to 30 June was a shortage of spare parts which made it difficult to keep the T-27 going.[18]

Variable Stability F-106B

Attempts to provide the school with an F-106B variable stability advanced trainer capability have been stalled repeatedly as noted in previous semiannual AFFTC histories. Recently though, Class V Modification Number 1288 was authorized which would eventually permit the conversion of two F-106Bs to aerospace vehicles suitable for training students the control characteristics of future space vehicles. The project has been funded for $1,800,000 released to the San Antonio Air Materiel Area (SAAMA) and SAAMA let request for proposals for the modification on 28 May 1965.[19] Procurement was competitive and would include design, installation, and flight test of two modified aircraft. Technical assistance to SAAMA was to be provided by the Research and Technology Division's Flight Dynamics Laboratory throughout the program.

Space Trainer Study

School authorities knew that simulator training never would replace the type of training derived from practical training in an advanced aerospace trainer. Therefore, a qualitative operational requirement (QOR) had been established in 1961 and updated annually since for a trainer similar to an X-15 that would provide piloted boost, space attitude control and zero G, reentry, approach and landing, and environmental and personal equipment training.[20] Investigations currently involved modifying operational high performance turbojets to acceptable advanced aerospace trainers beyond the rocket augmented F-104s being readied for the school. But a more appealing solution seemed to be X-15 rocket research aircraft modified with a second seat and conventional landing gear, for the experience and proof testing performed with these aircraft since 1959 left few unknowns in the critical high speed heating regimes.[21] The aerospace trainer

QOR had been revised 9 November 1964, resubmitted to AFSC (SCMOL) in accordance with Air Force letter (AFORQCT to AFSC) dated 8 January 1964, and currently was in USAF for staffing.[22] Just how much urgency ever will be attached to this QOR in view of the Air Force manned orbiting laboratory (MOL) program and the school mission to support MOL crew training was still conjectural.

MOL Support for Space Systems Division

A memorandum of understanding between Space Systems Division (SSD) and the AFFTC on 15 September 1964 delegated responsibility to the AFFTC for certain phases of MOL crew flight training.[23] The AFFTC agency designated to carry out the training was the USAF Aerospace Research Pilot School. To date, AFFTC support of SSD amounted to a few in-house studies, training program curriculums, and some assistance on facilities and materials requirements needed to accomplish MOL crew training mission.[24]

F-104 Aircraft Modification for Safe Zoom Flights

This task was added to the Engineering Service Project in October 1964 following the crash of F-104A USAF S/N 56-0764 during a zoom maneuver (high energy management flight) on 15 June.[25] Investigation of the accident pointed up a need for additional instrumentation to include UHF communications, angle of attack indicators, auxiliary electrical power, and radar flight path monitoring throughout each zoom maneuver.[26] Modification involved seven F-104As (previously reported erroneously as five F-104As and two F-104Bs) USAF Serial Numbers 56-0750, 56-0752, 56-0754, 56-0758, 56-0759, 56-0766, and 56-0826. Modification had been authorized as Class IVB under Sacramento Air Materiel

Area (SMAMA) Project 64-517, and the work would eventually be incorporated into a Technical Order (1F-104-913). All but USAF Serial Numbers 56-0752 and 56-0758 have been modified thus far, and successful zoom flights have been accomplished with three of the completed F-104s.[27]

F-104 Side-Stick Controller Modification

This task also was initiated in October 1964 to develop and evaluate a side-stick controller for two F-104B school aircraft that would provide training on the type of control sticks used in space research vehicles. The school prepared a purchase request for $200,000 on 15 January 1965 for development and delivery of two modification kits plus technical data and engineering services. A request for proposal (RFP) went out from AFFTC Procurement on 29 March. Replies from prospective contractors came back a month later and Douglas Aircraft Company was given the contract in May. Project manager for the task was the Aerospace Research Pilot School Training Research and Development Division. SMAMA accepted engineering responsibility for the program and the Flight Dynamics Laboratory of RTD agreed to assist SMAMA as needed.[28]

V/STOL Pilot Training

A new task added to ESP 922A-9060 (Updating the Technical Facilities and Capabilities of the Aerospace Research Pilot School) This historical interim was V/STOL Pilot Training. The school had documented the requirement for such training during 1964 when it became obvious that the Department of Defense soon would be faced with a critical shortage of trained V/STOL test pilots. In a lengthy study, the school staff pointed out that since DOD had no formal V/STOL test pilot training, current requirements for such pilots on a great number of

projects had to be met by qualified engineering test pilots without training; and the number of V/STOL programs would likely increase due to the use of V/STOL in limited wars and the acceptance of V/STOL by North Atlantic Treaty Organizations.[29] The school staff which had trained one class of eight army students in helicopter training in 1960[30] made it clear in the study that the Aerospace Research Pilot School with a relatively minor increase in resources could provide partially trained V/STOL test pilots by January 1966 and fully trained test pilots a year later. The study went forward to AFSC on 16 November 1964 over the signature of the AFFTC commander, Brigadier General Branch, who requested help in getting the proposed program underway.[31] Briefly, additional resources consisted mainly of three OH-13S helicopters, manpower, and funds now and four X-14T aircraft, manpower, and funds later.

Response to the proposed V/STOL test pilot training program was almost immediate. On 15 February 1965, the school obtained two OH-13E aircraft (USAF S/N 51-13809 and 51-13869) from Sharpe Army Air Depot,[32] California, another (51-13841) on 3 March and one (51-13793) 22 April.[33] The latter replaced OH-1E 51-13869 which was destroyed during a student training mission as indicated previously (page 41). Meanwhile the addition of V/STOL training to the USAF Aerospace Research Pilot School was documented as a new task by Memorandum Report 10 on 23 February 1965.[34] Fund-wise, V/STOL training during the remainder of FY-65 appeared to require $90,000, as much as $117,000 in FY-66, and over $200,000 for FY-67. The estimated fund needs however did not include $2,500,000 for the aforementioned X-14T which were not in the Air Force inventory. In the meantime, AFSC validated an AFFTC request for two officer and two civilian spaces to meet manpower requirements imposed by the new task.

In addition to the foregoing, four more civilians and two airmen were assigned as follows:

Mrs	Della N. Chase, Secretary to the Commandant.
Mrs	Carolyn J. Ritchey, Secretary, Training R & D Division.
Miss	Linda G. Wilson, Secretary, Aerospace Research Pilot Division.
Mrs	Jackie D. Burton, Secretary, Experimental Test Pilot Division.
SMSgt	Richard W. VanDenberg, Administrative Supervisor.
A3C	Michael T. Rompala Jr., Operations Dispatcher

Total personnel assigned by month follows:

	Jan	Feb	Mar	Apr	May	Jun
Officers	27	28	28	29	29	27
Airmen	2	2	2	2	2	2
Civilians	5	5	5	6	6	5
Students	33	33	32	24	36	36

Officer strength went from 28 in December to 27 in January 1965 when Captain Thompson dropped as an instructor and entered Class 65-A. The latter class of 13 students also raised student strength from 20 in December to 33 in January. Assignment of Captain Worden in February as an instructor in the Aerospace Research Pilot Division upped officers to 28 and the assignment of Captain Ralph to the Experimental Test Pilot Division in April raised officers to 29. Then in June Lieutenant Colonel Curtis went PCS to the Army War College, Major Currie and Lieutenant Darby were killed in the crash of their T-33 near Denver, and Major Torosian received an assignment with Space Systems Division's MOL program. Meanwhile, Lieutenant Colonel Austin A. Julian came in as a replacement for Colonel Curtis and Captain Robert E. Ross was picked up as an instructor in the Experimental Test Pilot Division. Thus the officer strength at 27 assigned on 30 June ended this period as it began. It was anticipated however that a sizeable

increase was in the offing, for manpower justifications submitted to Systems Command not yet allocated included 2 officer spaces to man a V/STOL training program to be incorporated into the experimental test pilot phase of instruction, 2 airmen and 1 civilian to work with the contractor on the T-27 Space Flight Simulator, 1 airman as supervisor of dispatch in the Operations Office, and 7 officer, 25 airman, and 2 civilian positions to man the newly acquired MOL program flight test crew training responsibility.[35]

Captain Roberto Starc of Argentina graduated from the experimental test pilot phase of Class 64-C on 12 March to drop the student strength as indicated in the foregoing table. In April, then, Class 64-B graduated eight students sending student strength to 24 for that month. The following month, however, Class 65-B of 12 students brought the number of students up to 36.

Aircraft and Flying Hours

Six aircraft were added to the school inventory this six months and four lost. Two of the gains were T-33A 53-5099 and T-33A 53-5188 picked up from Base Operations in January where they had been used as operational support aircraft for proficiency rated personnel not regularly assigned to crew positions. The remaining four aircraft were OH-13Es 51-13809, 51-13869, 51-13841, and 51-13793 gained from Sharpe Army Air Depot, California. Losses involved the crash of OH-13E 51-13869 on 23 February, the crash of T-33A 53-5188 near Denver on 27 June, another T-33A (52-9641) sent to reclamation on 9 March, and still another T-33A (56-3659) sent to Davis-Monthan AFB on 9 June. Aircraft remaining in the school inventory through 30 June 1965 were:[36]

Aircraft	Serial #	Date Gained	Aircraft	Serial #	Date Gained
NB-57E	55-4258	Oct 56	F-104A	56-0750	Jan 62
	55-4262	Oct 56		56-0752	15 Nov 64
	55-4267	Oct 56		56-0754	15 May 62
			NF-104A	56-0756	27 Sep 61
T-33	52-9425	Mar 58	F-104A	56-0758	30 Nov 64
	52-9846	Apr 59		56-0759	15 Oct 62
	53-5099	15 Jan 65	NF-104A	56-0760	15 Jan 62
	55-4378	21 Jan 64	F-104A	56-0766	15 Oct 62
	57-0549	19 Oct 61		56-0826	19 Aug 62
	57-0567	18 Oct 61	F-104B	56-3722	1 Jan 63
	57-0751	1 Sep 62		57-1304	20 Dec 61
				57-1307	22 Oct 62
JT-38A	58-1195	16 Aug 62	F-104D	57-1319	17 Apr 64
	59-1594	27 Apr 62			
	59-1595	4 May 62	F-106A	57-0238	5 Jul 62
	59-1596	27 Jun 62	F-106B	57-2519	31 Aug 62
	59-1597	3 Apr 62		57-2529	30 Jul 62
	63-8134	4 Feb 64			
	63-8135	4 Feb 64	OH-13E	51-13809	15 Feb 65
				51-13841	3 Mar 65
NF-101A	53-2422	27 Mar 63		51-13793	22 Apr 65

Flying hours:[37]

Jan	Feb	Mar	Apr	May	Jun
943:35	665:05	819:15	749:30	767:10	946:20

Training

From 5 June 1961 through the end of 1963 under the original concept of space training at the school, 41 space research pilots graduated from the aerospace research pilot course[38] and 60 experimental test pilots completed the experimental test pilot course of instruction.[39] As noted at the beginning of this chapter, the two courses were combined on 1 July 1963 into a two phase type of training activity with a provision whereby experimental test pilots graduated in six months and the remainder of the class continued on for another six months to graduate as aerospace research pilots. Class 63-A and Class 64-A under the

combined course concept graduated another 12 experimental test pilots and 25 space research pilots through 1964.[40]

Class 64-B

This class began on 4 May 1964 with 12 students. Upon recommendation of the faculty two weeks later, however, Captains Thomas E. Brand, Augustine R. Letto, and Robert I. McCann were dropped and, on 2 July, Captain Robert F. Bernado was dropped.[41] The remaining eight students as follows graduated on 27 April:

USAF Captains -	Assigned To -	Navy Lieutenants -	Assigned To -
Robert D. Freeman	APGC	Albert H. Best III	Point Mugu
Charles G. Fullerton	ASD	Marle D. Hewett	Point Mugu
Paul M. Jeglum	AFFTC		
Leslie D. Pruitt	ASD		
Thurlow H. Ralph	AFFTC		
Charles N. Stone	APGC		

Class 64-C

Thirteen students entered Class 64-C on 8 September 1964 as noted in the previous AFFTC semiannual history (page 190). Since then student Captain Jerry D. Bowline had to be hospitalized for surgery, and Argentinian Air Force Captain Roberto Starc graduated as an experimental test pilot on 12 March 1965. Class strength remained at 12 nevertheless, for Captain Worden who joined the Aerospace Research Pilot Division as an instructor on 15 February 1965 now was attending Class 64-C as an in-house student.[42] Otherwise Class 64-C proceeded according to schedule.

Class 65-A

Another 13 students and an in-house student entered training on 4 January 1965 as Class 65-A. The in-house student, Captain Frye, joined the faculty 5 October 1964 as an instructor with the Aerospace Research Pilot Division. Another student, Captain Thompson, also had been an instructor with the Aerospace Research Pilot Division since 21 December 1964, but only for the time that it took to

enroll as a student. Students were:[43]

USAF Captains -

Shirly A. Babin
Francis Belinne
Jerry D. Bowline
Laurence C. Curtis Jr
Frederick R. Dent III
Nathaniel O. DeVoll
Fred H. Ernst
Wayne T. Frye (in-house)
John W. Hines
James K. Olson
George E. Thompson
Donald L. Thurman

Navy Lieutenants -

Robert L. Crippen
Nicholas B. Temple

Class 65-B

And still another 12 students as follows began Class 65-B on 3 May 1965:[44]

USAF Captains -

Karol J. Bobko
Thomas G. Derrickson
Alan L. Devereaux
Charles J. Ferrari
Robert C. Hover
Glen M. Personius
James J. Reed Jr
Tracy A. Scanlan
Frank M. Smith
Roger J. Smith

Navy Lieutenant -

Thomas K. Mattingly

Navy Lieutenant Commander -

Edgar D. Mitchell

Total Students Trained

Since 4 February 1951 when what was to become the USAF Experimental Flight Test Pilot School and later the USAF Aerospace Research Pilot School moved from Wright-Patterson AFB, Ohio, the school has turned out 500 experimental test pilots and 74 aerospace research pilots to 30 June 1965. Moreover, 94 of the experimental test pilots trained by the school came as students from friendly nations (46), Air Force contractors (35), the Army (7), CAA (1), FAA (2), and NASA (3).[45] The 74 aerospace research pilot graduates all have been USAF except

seven from the Navy (Birdwell, Smith, Henry, Truly, Finley, Best, and Hewett), one from the Marine Corps (Weir), and one from NASA (Haise). Furthermore, five of the USAF aerospace trained pilots--Borman, Collins, Freeman, McDivitt, and Scott--have been picked as astronauts for the nations' space programs under NASA. Graduates of the USAF Experimental Flight Test Pilot School or the experimental test pilot phase of the USAF Aerospace Research Pilot School who have been selected by NASA as astronauts were Cooper, Grissom, Slayton, Stafford, White, and Eisele.[46]

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

On 4 February 1951, prior to relinquishing command of Edwards AFB to the newly created Air Research and Development Command (ARDC), Air Materiel Command (AMC) transferred to Edwards AFB the AMC Flight Test Pilot School which had been training selected AMC pilots for several years at Wright-Patterson AFB to perform flight tests on production and experimental aircraft. After the move, the AMC Flight Test Pilot School became the ARDC Experimental Flight Test Pilot School until 1 January 1953 when it became the USAF Experimental Flight Test Pilot School--a designation that reflected the school now accepted applicants on an Air Force-wide basis.[1] Operation of the school remained under control of ARDC, however; an unusual deviation from the accepted practice whereby Air Training Command exclusively operated all Air Force schools.[2] The USAF Experimental Flight Test Pilot School designation endured until 12 October 1961 when the facility became the USAF Aerospace Research Pilot School.[3]

Subsequent to 1961 the school curriculum consisted of two distinct courses--an experimental test pilot course and an aerospace research pilot course--each about seven months long. Students of the experimental test pilot course received training in the latest methods of testing and evaluating aircraft and related aeronautical equipment. Enrollment usually was made up of Air Force pilots, pilots of other services and agencies, pilots of allied nations, and pilots of Air Force contractors.

Aerospace research pilot course students were graduates of an experimental test pilot school selected to train as pilots and project officers for manned space programs.

The two-course concept of training following a trial period of two years was consolidated into a one-course, two-phase type training on 1 July 1963 with each phase corresponding to the old two-course training. Combining the two former courses compressed the over-all training time from about 16 months to one year; and in many instances, it reduced the permanent change of station per student (some students finished the experimental test pilot course, returned to their home station, and then returned to the school later for the aerospace course). Moreover, when there was a time lapse of any great length between graduation from the experimental test pilot course and entry into the aerospace research pilot course the student had to review certain basic engineering subjects and test flying theory at the beginning of the latter course. Under the single continuous course, training common to both courses had been combined, thus eliminating the need for basic review in the aerospace research pilot phase of instruction. Merging the two former courses also enhanced revision of the curriculum to keep it in harmony with the space-oriented evolution occurring in Air Force operations and testing. But more than all else, perhaps, the single course --by eliminating the time between courses--produced an aerospace research pilot younger than one trained in two courses,[4] and this was important in view of the dwindling pool of young test pilots available and qualified for aerospace research pilot training.

Training Facilities and Equipment

Headquarters USAF since May 1962 actively supported Engineering Service Project (ESP) 922A-9060 to update school technical facilities and capabilities.[5] The school under the ESP had received funds for new facilities, obtained additional aircraft, and augmented manpower authorizations as necessary to train annually 36 research pilots for manned space flight[6] and 12 experimental test pilots. Fund-wise, the school received approval to spend more than $10 million for space training aids and equipment to facilitate training.[7] Equipment at end of this reporting period included a static space simulator, a static aerodynamic simulator, a T-27 space flight simulator, a reaction control trainer, an F-106A devoid of variable lift/drag (L/D), and three OH-13 helicopters for student V/STOL training. In addition, there were two F-104A aircraft augmented with rocket engines and ballistic controls to provide experience under zero gravity conditions and to provide training in energy management and re-entry techniques.[8]

NF-104A Rocket and Ballistic Control Augmented Trainer

Lockheed California Company at a cost of $5,363,322 modified three F-104As to the NF-104A configuration by adding an LR-121-NA-1 rocket engine to each and augmenting the aerodynamic controls with reaction controls for space student training at altitudes in the neighborhood of 120,000 feet. Lockheed also replaced the F-104A vertical tail with a TF-104G vertical tail, replaced the J79-3A engine with a J79-3B, and pressurized the cockpit with nitrogen.

Lockheed finished their work in mid-1963 and delivered NF-104A USAF Serial Number 56-760 from Palmdale to AFFTC on 1 October, USAF S/N 56-672 on 26 October, and USAF S/N 56-756 on 1 November.[9] One of the airplanes went to the Deputy for Systems Test for a flight test evaluation to determine if the NF-104A had acceptable flying qualities for its design mission and the other two went to the school for instructor checkout.

Only three instructors--Lt Col Robert S. Buchanan, Major Robert H. McIntosh and Captain Frank E. Liethen Jr--and the school commandant ever checked out in the NF-104; none of the three aircraft ever has been used for student training.[10] One of the airplanes (USAF S/N 56-762) at the school crashed to destruction on 10 December 1963 following a zoom maneuver,[11] and the other airplane at the school (USAF S/N 56-760) joined the one in test at the Deputy for Systems Test. Test and evaluation of these airplanes was complete on 16 February 1965; both airplanes returned to the school inventory for instructor checkout within the limitations now imposed as a result of the long evaluation during flight test.[12]

Several new development items had been added while the NF-104A was in a test status to make it even reasonably safe. Yet it still could not be used as an aerospace trainer unless certain flight restrictions were imposed.[13] In addition, testing thus far proved conclusively that the NF-104A would require an intimate knowledge of the aircraft and its flight characteristics for it was extremely sensitive at high altitudes. Further, airplane maintenance had become a severe problem because of the many modifications made to the aircraft and its systems since it had been in test.[14]

Only one of the two NF-104As being used for instructor checkout was still flying at the end of December 1965, for USAF S/N 56-756 had received major damage to a wing and the aft under fuselage while returning from a zoom climb maneuver on 18 June when an explosion occurred following a failure in a hydrogen peroxide line leading to a reaction control motor.[15]

On 20 July 1965, investigation was completed on the S/N 56-756 accident. The primary cause of the accident was determined to be materiel failure. The O-rings in the reaction control hydrogen peroxide (H_2O_2) system slip joint failed, allowing H_2O_2 to leak into the aircraft and decompose, causing an explosion.[16]

T-27 Static Space Simulator

The space flight simulator that began 30 November 1962 under contract to the Link Division, General Precision, Inc., at a cost-plus incentive fee price of $3,481,000 finally began arriving at the school on 5 October 1964. Contractor development problems associated with the visual system (Mission Effects Projector), computer system, and moving base system, caused some delay in delivery and cost another $1,440,000 as well.[17] Additional overrun on the space flight simulator mission effects projector portion of the visual system was estimated to be as much as another $240,000

Student training in the $5,500,000 static space simulation facility in a new wing of the school began in February 1965, although the T-27 still lacked the mission effects projector portion of the visual system.[18] The space flight simulator was complete enough now, however, to provide realistic

orbital launch, rendezvous, and docking space flight training locally for the first time in almost four years of turning out space pilots, project managers, and space flight consultants. Investigations were continuing with regard to expanding the T-27 space flight simulator capability to include simulation of the Manned Orbiting Laboratory (MOL) system Gemini-B vehicle and mission characteristics.

As of December 1965 over 75 modifications involving hardware were made; these ranged from the installation of additional head-set jacks to the addition of a new program instruction to the Mark II computer. More than 250 program changes were made, ranging from an instrument pointer polarity reversal to the programming of complete new vehicles.[19] More than 1,000 simulated launches were made as of December 1965, as well as 1,000 rendezvous, and 1,000 re-entries.[20]

The T-27 Space Flight Simulator was completely accepted by the Air Force except for: (1) Mission Effects Projector portion of the Visual System: (2) Some debugging of the high L/D re-entry portion of the program. Delivery date for the MEP portion of the Visual System was set for 1966.[21]

Variable Stability F-106B

Attempts to provide the school with an F-106B variable stability advanced trainer capability have been stalled repeatedly as noted in previous semiannual AFFTC histories. However, Class V Modification Number 1288 was authorized which would eventually permit the conversion of two F-106B to aerospace vehicles suitable for training students the control characteristics of future space vehicles. The project was funded for $1,800,000

released to the San Antonio Air Materiel Area (SAAMA) and SAAMA let request for proposals for the modification on 28 May 1965.[22] Procurement was competitive and would include design, installation, and flight test of two modified aircraft. Technical assistance to SAAMA was to be provided by the Research and Technology Division's Flight Dynamics Laboratory throughout the program.

Proposals were received from four companies. There was considerable hold-up in procurement action (from September to December) resulting from delayed processing of the Revised Form 440 in Hq USAF.[23]

Space Trainer Study

School authorities knew that simulator training would never replace the type of training derived from practical training in an advanced aerospace trainer. Therefore, a qualitative operational requirement (QOR) had been established in 1961; it has been updated annually since for a trainer similar to an X-15 that would provide piloted boost, space attitude control and zero G, re-entry, approach and landing, and environmental and personal equipment training.[24] Investigations involved modifying operational high performance turbojets to acceptable advanced aerospace trainers beyond the rocket augmented F-104 currently available. But a more appealing solution seemed to be X-15 rocket research aircraft modified with a second seat and conventional landing gear; experience and proof testing performed with these aircraft since 1959 left few unknowns in the critical high speed heating regimes.[25]

The aerospace trainer QOR had been revised 9 November 1964, resubmitted to AFSC (SCMOL) in accordance with Air Force letter (AFORQCT to AFSC) dated 8 January 1964, and currently was in USAF for staffing.[26]

MOL Support for Space Systems Division

A memorandum of understanding between Space Systems Division (SSD) and the AFFTC on 15 September 1964 delegated responsibility to the AFFTC for certain phases of MOL crew flight training.[27] To date, AFFTC support of SSD amounted to a few in-house studies, training program curricula, and some assistance on facilities and materials requirements needed to accomplish MOL crew training mission. However, eight MOL crews were selected to start training shortly. Details of the training course were worked out between ARPS and the MOL program office.[28]

F-104 Aircraft Modification for Safe Zoom Flights

This task was added to the Engineering Service Project in October 1964 following the crash of F-104A USAF S/N 56-0764 during a zoom maneuver (high energy management flight) on 15 June 1964.[29] Investigation of the accident pointed up a need for additional instrumentation to include UHF communications, angle of attack indicators, auxiliary electrical power, and radar flight path monitoring throughout each zoom maneuver.[30] Modification involved seven F-104As: USAF Serial Numbers 56-0750, 56-0752, 56-0754, 56-0758, 56-0759, 56-0766, and 56-0826. Modification had been authorized as Class IVB under Sacramento Air Materiel Area (SMAMA) Project SMNE 64-517, eventually culminating in Technical Order 1F-1-4-913.[31]

F-104 Side-Stick Controller Modification

This task also was initiated in October 1964 to develop and evaluate a side-stick controller for two F-104B school aircraft that would provide training on the type of control sticks used in space research vehicles. The school prepared a purchase request for $200,000 on 15 January 1965 for development and delivery of two modification kits plus technical data and engineering services. A request for proposal (RFP) went out from AFFTC Procurement on 29 March 1965. Replies from prospective contractors came back a month later and Douglas Aircraft Company was given the contract in May. Project manager for the task was the ARPS Training Research and Development Division. SMAMA accepted engineering responsibility for the program and the Flight Dynamics Laboratory of RTD agreed to assist SMAMA as needed.[32] The AFFTC Deputy for Maintenance was given the responsibility of installing the kits.[33]

V/STOL Pilot Training

A new task had been added to ESP 922A-9060 (Updating the Technical Facilities and Capabilities of the ARPS). This was the V/STOL Test Pilot Training Program. The school had documented the requirement for such training during 1964 when it became obvious that the Department of Defense soon would be faced with a critical shortage of trained V/STOL test pilots. In a lengthy study, the school staff had pointed out that since DOD had no formal V/STOL test pilot training, current requirements for such pilots on a great number of projects had to be met by qualified engineering test pilots without training; further, the number of V/STOL programs would likely increase

due to the use of V/STOL in limited wars and the acceptance of V/STOL by North Atlantic Treaty Organizations.[34] The school staff which had trained one class of eight Army students in helicopter training in 1960[35] made it clear in the study that the Aerospace Research Pilot School with a relatively minor increase in resources could provide partially trained V/STOL test pilots by January 1966 and fully trained test pilots a year later. The study went forward to AFSC on 16 November 1964 over the signature of the AFFTC commander, Brigadier General Branch, who requested help in getting the proposed program underway.[36]

Response to the proposed V/STOL test pilot training program was almost immediate. On 15 February 1965, the school obtained two OH-13E aircraft (USAF S/N 51-13809 and 51-13869) from Sharpe Army Air Depot,[37] California, another (51-13841) on 3 March and one (51-13793) 22 April.[38] Meanwhile, the addition of V/STOL training to the USAF Aerospace Research Pilot School was documented as a new task by Memorandum Report 10 on 23 February 1965.[39] Fund-wise, V/STOL training during the remainder of FY-65 required $90,000, $117,000 in FY-66, and over $200,000 for FY-67. The estimated fund needs, however, did not include $2,500,000 for four X-14T aircraft, a needed resource not in the Air Force inventory.

Pending results of a joint AFFTC-ASD study, the target delivery date of 1 January 1966 was deemed impossible.[40]

School Staff and Faculty

Commandant	Col	Charles E. Yeager	23 Jul 62 -
Deputy	Lt Col	Austin A. Julian Jr	21 Jun 65 -
Operations O	Capt	Robert N. Broughton	20 Jan 64 -

Executive	Maj	James A. Boulihan	24 Aug 62 -	
Chief of Admin	1st Lt	Adam S. Brown	26 Feb 64 -	
Ch, R&D Trng Div	Capt	Clifford H. Allen Jr	3 Jan 64 -	
Ch, Rsch Plt Div	Lt Col	Robert S. Buchanan	15 Jan 62 -	
Ch, Operations Br	Maj	Robert H. McIntosh	1 Jul 65 -	
Ch, Academic Br	Maj	Norris J. Hanks	1 Jun 64 -	
Ch, Simulation Br	Maj	John Prodan	1 Jun 64 -	
Instructors	Maj	Frank E. Liethen Jr	27 Dec 63 -	Nov 65
	Maj	Albert H. Crews Jr	29 Jun 64 -	29 Nov 65
	Capt	Richard E. Lawyer	10 Jul 64 -	29 Nov 65
	Maj	Wayne T. Frye	5 Oct 64 -	
	Capt	Alfred M. Worden	15 Feb 65 -	
	Capt	Darius W. Gaskins Jr	4 Mar 64 -	
	Capt	Charles M. Duke Jr	3 Sep 65 -	
	Capt	Henry W. Hartsfield Jr	3 Sep 65 -	
	Maj	William R. Pogue	6 Dec 65 -	
	Lt USN	Richard H. Truly	Jan 65 -	29 Nov 65
Ch, Experimental Test Plt Div	Maj	George D. Hendrix	10 Jan 63 -	
Ch, Performance Br	Maj	Orgle D. Godwin	12 Nov 63 -	
Ch, Stab & Cont Br	Maj	Russell S. Buker	-	6 Jul 65
	Maj	David H. Tittle	7 Jul 65 -	
Instructors	Capt	John A. Morrison	18 Aug 62 -	16 Aug 65
	Capt	Walter J. Schob Jr	9 Jul 63 -	
	Capt	Tommy I. Bell	27 Dec 63 -	
	Maj	Frank D. Frazier	27 Dec 63 -	15 Dec 65
	Maj	Robert E. Ross	8 Jun 65 -	
	Capt	Thurlow H. Ralph	28 Apr 65 -	
	Lt USN	John L. Finley	Jan 65 -	29 Nov 65

Total personnel assigned by month follows:

	Jul	Aug	Sep	Oct	Nov	Dec
Officers	26	25	27	26	23	23
Airmen	2	2	2	2	2	2
Civilians	5	3	3	5	5	5
Students	36	50	39	39	39	39

Aircraft and Flying Hours

Two aircraft were added to the school inventory during this reporting period and one lost. The gains were T-33 57-0609 (31 July 1965) and F-104B 57-1301 (3 December 1965). The loss was F-106A 57-0238. This aircraft crashed on Edwards AFB on 6 December. Aircraft comprising the school inventory through 31 December 1965 were:[41]

Aircraft	Serial #	Date Gained	Aircraft	Serial #	Date Gained
NB-57E	55-4258	Oct 56	F-104A	56-0750	Jan 62
	55-4262	Oct 56		56-0752	15 Nov 64
	55-4267	Oct 56		56-0754	15 May 62
			NF-104A	56-0756	27 Sep 61
T-33	52-9425	Mar 58	F-104A	56-0758	30 Nov 64
	52-9846	Apr 59		56-0759	15 Oct 62
	53-5099	15 Jan 65	NF-104A	56-0760	15 Jan 62
	55-4378	21 Jan 64	F-104A	56-0766	15 Oct 62
	57-0549	19 Oct 61		56-0826	19 Aug 62
	57-0567	18 Oct 61	F-104B	56-3722	1 Jan 63
	57-0751	1 Sep 62		57-1304	20 Dec 61
	57-0609	31 Jul 65		57-1307	22 Oct 62
				57-1301	3 Dec 65
JT-38A	58-1195	16 Aug 62	F-104D	57-1319	17 Apr 64
	59-1594	27 Apr 62			
	59-1595	4 May 62	F-106B	57-2519	31 Aug 62
	59-1596	27 Jun 62		57-2529	30 Jul 62
	59-1597	3 Apr 62			
	63-8134	4 Feb 64	OH-13E	51-13809	15 Feb 65
	63-8135	4 Feb 64		51-13841	3 Mar 65
				51-13793	22 Apr 65
NF-101A	53-2422	27 Mar 63			

Flying hours:[42]

Jul	Aug	Sep	Oct	Nov	Dec
816:20	328:40	394:25	712:10	786:45	696:00

Training

From 5 June 1961 through the end of 1963--under the original concept of space training at the school--41 space research pilots graduated from the aerospace research pilot course[43] and 60 experimental test pilots completed the experimental test pilot course of instruction.[44] As noted earlier in this chapter, the two courses were combined on 1 July 1963 into a two-phase type of training activity with a provision whereby experimental test pilots graduated in six months; the remainder of the class continued on for another six months to graudate as aerospace research pilots. Class 63-A and Class 64-A under the combined course concept graduated another 12 experimental test pilots and 25 space research pilots through 1964.[45]

Class 65-C

This class started on 30 August with the following students:[46]

USAF Captains -

Thomas J. Davey
Norman K. Dyson
Gordon E. Fornell
Warwick H. Glasgow
James F. Heye
Warren J. Kerzon
Donald J. Kutyna
James G. Rider
Thomas H. Smith
James T. Strader

Navy Lieutenant Commander -

Leroy B. Keely

Navy Captain -

Robert F. Overmyer

Italian AF Captain -

Vittorio Meneghini

Class 64-C

This class was graduated on 3 September 1965. Major General Horace A. Hanes was guest speaker. Captain Peter C. Hoag was recipient of the Honts

Award. Graduates were:

USAF Captains -

Spence M. Armstrong
Charles M. Duke Jr.
Barron Fredericks III
Henry W. Harsfield Jr.
Peter C. Hoag
Wendell R. Hull
Gerald D. Larson
Stuart A. Roosa
Floyd B. Stroup
Alfred M. Worden (In-house student)

Navy Lieutenant -

Gary L. Moore

USMC Captain -

Joseph B. Wuertz

Total Students Trained

Since 4 February 1951 when what was to become the USAF Experimental Flight Test Pilot School and later the USAF Aerospace Research Pilot School moved from Wright-Patterson AFB, Ohio, the school has turned out 500 experimental test pilots and 86 aerospace research pilots to 31 December 1965. Moreover, 94 of the experimental test pilots trained by the school came as students from friendly nations (46), Air Force contractors (35), the Army (7), CAA (1), FAA (2), and NASA (3).[47] The 86 aerospace research pilot graduates all have been USAF except eight from the Navy (Birdwell, Smith, Henry, Truly, Finley, Best, Hewett, and Moore), two from the Marine Corps (Weir and Wuertz), and one from NASA (Haise). Furthermore, five of the USAF aerospace-trained pilots--Borman, Collins, Freeman, McDivitt, and Scott--have been picked as astronauts for the nation's space programs under NASA. Graduates of the USAF Experimental Flight Test Pilot School or the experimental test pilot phase of the USAF Aerospace Research Pilot School who have been selected by NASA as astronauts were Cooper, Grissom, Slayton, Stafford, White, and Eisele.[48]

Hist Jul-Dec 64

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

Since 1 July 1963 the USAF Aerospace Research Pilot School has discharged its mission by training select pilots to monitor and conduct flight tests of research, experimental, or production type aerospace vehicles through a combined aerospace research pilot course divided into two distinct phases--an experimental test pilot phase and an aerospace research pilot phase. The experimental test pilot phase trained Air Force pilots, pilots of other services and agencies, pilots of allied nations, and pilots of Air Force contractors in the latest method of testing and evaluating aircraft and related aeronautical equipment. The aerospace research pilot phase trained selected graduates of the experimental test pilot phase as pilots and project officers for manned research programs. Each phase was six months long.[1] Prior to introduction of the one course two phase system of training the school consisted of two courses --an experimental test pilot course and an aerospace research pilot course--each about seven months long.

Combining the two courses compressed the over-all training time from about 16 months to one year, and in many instances it reduced the permanent change of station per student (some students finished the experimental test pilot course, returned to their home station, and then returned to the school later for the aerospace course). Moreover, when there was a time

lapse of any great length between graduation from the experimental test pilot course and entry into the aerospace research pilot course the student had to review certain basic engineering subjects and test flying theory at the beginning of the latter course. Under the single continuous course, training common to both courses had been combined thus eliminating the need for basic review in the aerospace research pilot phase of instruction. Merging the two former courses also enhanced revision of the curriculum to keep it in harmony with the space oriented evolution occurring in Air Force operations and testing. But more than all else, perhaps, the single course by eliminating the time between courses produced an aerospace research pilot younger than one trained in two courses,[2] and this was important in view of the dwindling pool of young test pilots available and qualified for aerospace research pilot training.

Organization

Organization of the school reflected clearly its training mission. Two training divisions under the school commandant, Colonel Charles E. Yeager, received support from an executive office and a training research and development division. The latter division functioned as a project office for design, development, and procurement of special training devices to fulfill the space training mission. The chart which follows on the next page reflects the basic organization, and page 182 provides a further breakdown of organization through branches and offices.

Training Facilities and Equipment

Headquarters USAF since May 1962 actively supported Engineering Service Project (ESP) 922A-9060 to update school technical facilities and capabilities.[3] The school under the ESP had received funds for new facilities, obtained additional aircraft, and augmented manpower authorizations as necessary to train annually 36 research pilots for manned space flight[4] and 12 experimental test pilots. Fund-wise, the school received approval to spend more than $10 million for space training aids and equipment to facilitate training.[5] New equipment by 1964 included a variable lift/drag (L/D) F-106A, an interim static simulator and a ballistic control simulator manufactured locally,[6] a static space flight simulator,[7] and three F-104A aircraft augmented with rocket engines and ballistic controls purchased to provide experience under zero gravity conditions and to provide training in energy management and re-entry techniques.[8] One of the latter aircraft (USAF S/N 56-762) being used at the school for instructor checkout crashed on 10 December 1963 following a zoom maneuver.[9] The two remaining rocket augmented F-104s remained in rocket engine powered zoom tests through 1964.

The space flight simulator which began 30 November 1962 under contract to the Link Division, General Precision, at a cost plus incentive fee price of $3,481,000 finally began arriving at the school on 5 October 1964. Contractor development problems associated with the visual system (Mission Effects Projector), computer system, and moving base system, caused some delay in delivery and cost another $1,440,000 as well.[10] Additional overrun on the space flight simulator mission effects projector portion of the visual system was estimated

to be as much as another $240,000. Nevertheless, installation of the simulator had progressed sufficiently by 28 December to permit a dedication ceremony in which the Air Force Vice Chief of Staff, General John P. McConnell, officially accepted the T-27 Space Flight Simulator from Link Group President, Mr. Lloyd L. Kelly.[11]

When the new $5,500,000 facility becomes fully operational in early 1965,[12] it will provide realistic orbital launch, rendezvous, and docking space flight training in a new wing of the school completed by Santa Fe Engineers in April 1964. The huge tilting 15-ton mechanism was designed to simulate motion, sight, and sound of space flight and thus enable the school to provide complete mission training locally for the first time in three years of turning out space pilots, project managers, and space flight consultants.

Tasks of the original ESP still pending at the end of 1964 included variable stability F-106s and an advanced space trainer study. The project to modify two F-106Bs into variable stability aircraft for training aerospace research pilot students in control characteristics of future aerospace vehicles had been delayed repeatedly as noted in the preceding AFFTC semiannual history (page 126). It now appeared that Class V Modification funding might be reinstated at $2 million and, if so, a request for proposal will be released sometime in 1965 to include design, installation, and flight test of F-106Bs.[13] Work on obtaining an advanced aerospace trainer similar to an X-15 to provide piloted boost, space attitude control and zero g, reentry, approach and landing, and environmental and personal equipment training mainly consisted of updating annually the initial study prepared prior to introduction of space training in the school.[14]

However, there appeared to be more urgency now in acquiring a qualified advanced space trainer in view of the Air Force manned orbiting laboratory (MOL) program announced in December 1963 with cancellation of the X-20 Dyna-Soar. Investigations currently involved the feasibility of modifying operational high performance turbojets to an acceptable advanced aerospace trainer beyond that already accomplished with the two rocket augmented F-104s being zoom tested and readied for the school. But a more appealing solution to the advanced aerospace trainer problem seemed to be X-15 rocket research aircraft modified with a second seat and conventional landing gear, for the experience and proof testing performed with these aircraft since 1959 left few unknowns in the critical high speed heating regimes.[15]

Three new tasks were added to the ESP in October 1964 to update technical facilities and capabilities of the school beyond that already accomplished. One of the new tasks began when the Flight Test Center acquired responsibility for a portion of flight crew training for the Air Force MOL program. The degree of Aerospace Research Pilot School participation in support of MOL crew training was worked out between the Space Systems Division (SSD) and the Flight Test Center on 15 September 1964.[16] At that time the school was designated specifically as ". . . the agency to conduct the training covered by this agreement . . . ." The Flight Test Center in connection with the new MOL task requested SSD include in the MOL Systems Package Program $375,000 for construction of two wings to the existing Aerospace Research Pilot School Building Number 1220. For it was anticipated that this would be sufficient to provide another 17,670 square feet of floor space in the school that now has

only 19,147 square feet to meet the new requirements of the MOL program (31 MOL personnel and heating and cooling facilities).[17]

Another of the new tasks added to the ESP in October stemmed from the crash of F-104A USAF S/N 56-0764 during a zoom flight (high energy management flight) on 15 June.[18] Following the loss of 0764, zoom flights by students in the school were suspended pending modification of five F-104As and two F-104Bs to include UHF communications, angle of attack indicators, auxiliary electrical power, and radar flight path monitoring throughout a zoom maneuver.[19] Rework under this task did not involve major funding since it would be performed by the Sacramento Air Materiel Area (SMAMA) if beyond the scope of local maintenance.

The third and final task to be added to the ESP during October actually had been under consideration since May 1964 and consisted of developing and evaluating a side-stick controller for two F-104B school aircraft to provide training on the type of control sticks used in space research vehicles. A request for proposal had been issued in May when $80,000 became available, but price estimates to develop two modification kits and associated technical equipment were far beyond funds authorized for the project. Nothing further developed on this task during the remainder of 1964, but the school research and development division planned to re-initiate this task in early 1965 in the amount of $220,000 to fund the side-stick controller and have local maintenance install the kits.[20]

In addition to the foregoing, four more civilians and two airmen were assigned to the school as follows:

Mrs Della N. Chase, Secretary to the Commandant.
Mrs Carolyn J. Ritchey, Secretary, Training R & D Division.
Miss Linda G. Wilson, Secretary, Aerospace Research Pilot Division.
Mrs Jackie D. Burton, Secretary, Experimental Test Pilot Division.
MSgt Richard W. VanDenberg, Administrative Supervisor.
A1C Melvin Stark, Operations Office Dispatcher.

Total personnel assigned by month follows:[32]

	Jul	Aug	Sep	Oct	Nov	Dec
Officers	26	26	28	29	28	28
Airmen	2	2	2	2	2	2
Civilians	5	5	5	5	5	5
Students	20	20	33	33	33	20

Captain Lawyer who was assigned directly to the Aerospace Research Pilot Division as an instructor the day following his graduation with Class 63-A on 9 July increased the school strength from 25 in June to 26 in July. Also, the assignment of Captain Thompson on 21 September as an astronautical engineer with the Aeropsace Pilot Division pending his entry in Class 65-A, the arrival of Lieutenant Darby on 29 September as an instructor, and assignment of Captain Frye on 5 October increased officer strength to 28 in September and 29 in October. But assigned officers dropped to 28 again in November when Flight Lieutenant Durnin (RCAF), an exchange officer instructor, departed for duty at Air Force Plant 42, in Palmdale, California.[33]

The number of people authorized remained at 23 officers, 3 airmen, and 5 civilians[34] as reported in the immediately preceding Flight Test Center

semiannual history (page 129). It was anticipated however that a sizeable increase was in the offing, for manpower justifications submitted to Systems Command and not yet allocated included 2 officer spaces to man a V/STOL training program to be incorporated into the experimental test pilot phase of instruction, 2 airmen and 1 civilian to work with the contractor on the T-27 Space Flight Simulator, 1 airman as supervisor of dispatch in the Operations Office, and 7 officer, 25 airman, and 2 civilian positions to man the newly acquired MOL program flight test crew training responsibility.[35]

Aircraft and Flying Hours

Aircraft in the school inventory seemed to be sufficient to meet normal training requirements except for a shortage of F-104s brought on partly by the loss of NF-104A USAF S/N 56-0764 on 15 June and F-104B USAF S/N 57-1308 on 18 February 1964. At the time of these losses the school already felt a need for two additional F-104s. Therefore a total requirement of four additional F-104s to meet training demands had been submitted to USAF through Systems Command in June.[36] But due to the shortage of this type airplane Systems Command had to come up with the aircraft from internal sources if they ever were made available for training purposes. Accordingly, Air Proving Ground Center which had furnished F-104A USAF S/N 56-0752 for the Strake test discussed herein previously (page 156) lost that airplane to the school in November as well as F-104A USAF S/N 56-0758 by direct transfer in November.[37] Aircraft in the school inventory through December were:

Aircraft	Serial #	Date Gained	Aircraft	Serial #	Date Gained
NB-57E	55-4258	Oct 56	NF-101A	53-2422	27 Mar 63
	55-4262	Oct 56			
	55-4267	Oct 56	F-104A	56-0750	Jan 62
				56-0752	15 Nov 64
				56-0754	15 May 62
T-33	52-9425	Mar 58	NF-104A	56-0756	27 Sep 61
	52-9641	Mar 58	F-104A	56-0758	30 Nov 64
	52-9846	Apr 59		56-0759	15 Oct 62
	55-4378	21 Jan 64	NF-104A	56-0760	15 Jan 62
	56-3659	21 Jan 64	F-104A	56-0766	15 Oct 62
	57-0549	19 Oct 61		56-0826	19 Aug 62
	57-0567	18 Oct 61	F-104B	56-3722	1 Jan 63
	57-0751	1 Sep 62		57-1304	20 Dec 61
				57-1307	22 Oct 62
JT-38A	58-1195	16 Aug 62	F-104D	57-1319	17 Apr 64
	59-1594	27 Apr 62			
	59-1595	4 May 62	F-106A	57-0238	5 Jul 62
	59-1596	27 Jun 62	F-106B	57-2519	31 Aug 62
	59-1597	3 Apr 62		57-2529	30 Jul 62
	63-8134	4 Feb 64			
	63-8135	4 Feb 64			

Flying Hours:[38]

Jul	Aug	Sep	Oct	Nov	Dec
769:05	700:15	710:10	886:00	641:05	529:20

Training

From 5 June 1961 through the end of 1963 under the original concept of space training at the school, 41 space research pilots graduated from the aerospace research pilot course[39] and 60 experimental test pilots completed the experimental test pilot course of instruction.[40] As noted at the beginning of this chapter, the two courses were combined on 1 July 1963 into a two phase type of training activity with a provision whereby experimental

test pilots graduated in six months and the remainder of the class continued on for another six months to graduate as aerospace research pilots. The school proposed to graduate 54 aerospace research pilots and 18 experimental test pilots annually under the new training concept.[41] But the Air Force lacking a clearly defined military space mission upon which to base student output cut the school proposal back to 36/12 annually allocated as follows:[42]

Aerospace Research Pilots		Experimental Test Pilots	
Air Force	30	NASA	4
Navy & Marine Corps	6	Military Aid Program	6
		Other Countries	2

Class 63-A

Class 63-A which began on 1 July 1963 with 18 students made up the first combined course. Eight of the 18 students graduated on 20 December 1963 as experimental test pilots[43] and the remaining 10 students along with Captain William J. Knight, a previous graduate of the Experimental Test Pilot School (58-C), continued on seeking graduation as aerospace research pilot/engineer qualified officers. On 9 July 1964 the class graduated in ceremonies which included Dr. Albert C. Hall, Department of Defense deputy director of research and engineering for space, as guest speaker. Graduates and their assignments were:[44]

USAF Captains -

Robert S. Beale	APGC
James R. Dunbar	AFMDC
Jerauld R. Gentry	AFFTC
John S. Hardy	APGC
William J. Knight	AFFTC
Richard E. Lawyer	AFFTC
Charles R. Rosburg	AFFTC
James H. Stanley	ADC
Joseph F. Stroface	AFFTC
James M. Taylor	AFMDC

USAF Major -

Norris J. Hanks (AFFTC in-house student)

US Navy Lieutenant -

Patrick Henry Jr.

Class 64-A

The second combined class beginning on 6 January 1964 graduated four of its 16 students on 9 July also but as experimental test pilots of Class 64-A. They were:[45]

USAF Captain - David W. Thomas assigned to the AFFTC

NASA Civilian - Donald Mallick

Netherlands First Lieutenant - Jacob Hofstra

RCAF Flight Lieutenant - Clifford H. Wilkinson

General John P. McConnell the Air Force Vice Chief of Staff addressed the remaining students who graduated on 22 December as follows:[46]

USAF Captains -

Ronald V. Franzen	AFFTC
Ernest F. Hasselbrink	Tyndall AFB
James W. Hurt III	AFSWC
David W. Livingston	AFFTC
George J. Marrett	AFFTC
Richard E. Strickland	APGC
Gervasio Tonini	AFFTC
Richard K. Voehl	APGC
Robert E. Whelan	AFFTC

Walter J. Schob (AFFTC in-house student)

NASA Civilian -

Fred W. Haise

Navy Lieutenants -

John L. Finley
Richard H. Truly

Class 64-B and 64-C

Meanwhile, Class 64-B which began on 4 May with 12 students proceeded on schedule. As pointed out in the preceding history (page 126) however, only 9 of the original 12 students remained after 18 May because three had been dropped on recommendations of the faculty.

Class 64-C with 13 students assigned as follows entered training on 8 September:[47]

USAF Captains -

Spence M. Armstrong
Jerry D. Bowline
Charles M. Duke Jr
Barron Fredricks III
Henry W. Hartsfield Jr
Peter C. Hoag
Wendell R. Hull
Gerald D. Larson
Stuart A. Roosa
Floyd B. Stroup

Navy Lieutenant -

Gary L. Moore

Marine Corps Captain -

Joseph E. Wuertz

Argentina Air Force Captain -

Roberto Starc

Student Jerry D. Bowline became hospitalized for surgery after the class began and will be held over for entry in Class 65-A or another class next year. Also it may be anticipated that Captain Starc of Argentina would be the only experimental test pilot to graduate from Class 64-C.

Cost of Training

Cost per Air Force student now in the one year two phase course exceeded $80,000[48] while non-Air Force ran roughly from $28,000 for a military assistance program student to $38,000 for a Navy student.[49] Minimum possible cost in any case though was $28,000. For example, NASA and other civilian government agencies were asked to reimburse the Air Force $28,000 plus $2,000 maintenance costs and a contractor student was charged off at the basic $28,000 plus $4,000 maintenance. The first NASA Civilian ever graduated was Bruce A. Peterson of Class 62-C. Messrs Gerdes, Mallick, and Haise of NASA who finished the school since then seemingly could become the last, for NASA Headquarters balked at the Air Force reimbursement policy in this instance calling it "shortsighted" in view of the non-reimbursable work NASA performed for the Air Force.[50]

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

From January 1961 to 30 June 1963 an Air Force space pilot training capability had been developed quietly on a small scale with limited funds at the Flight Test Center. Preparation of a suitable curriculum was the first major obstacle to be overcome, and it was hurdled with the aid of the National Aeronautics and Space Administration, contractors that were in the space field, and universities that were doing space research. These agencies were visited time and again by the school faculty to gather views of their top space personnel on what would constitute an acceptable course of instruction to form a nucleus of space-trained test pilots for Air Force aerospace programs and operations as they materialized. The second major obstacle which had to be dealt with was equipment and training aid shortages. This too was overcome initially with the assistance of the National Aeronautics and Space Administration, contractors, universities, and the Navy although it meant the engineer-pilot student had to travel about the country for simulator, computer, centrifuge, and even some academic training and instruction. Once an aerospace curriculum had been drawn up and arrangements completed for use of out-house space training facilities, four instructors of the former USAF Experimental Flight Test Pilot School and one experimental test pilot went through the seven month course to debug it while gaining instructor competency to teach it. That first class of five graduated 15 December 1961 to inaugurate a space pilot training capability

which to the end of December 1963 not counting those of the first class put 36 graduates into a pool of highly skilled test pilots who were able to take over as space pilots, engineers, or managers of aerospace projects.

The staff organized and reorganized to incorporate the space training course into the school, and additional qualified space instructors were added to the school during the first two years following introduction of the aerospace research pilot course. Concurrently, space training aids were developed in-house at considerable savings to the Air Force and other long lead-time items were contracted for through procurement.[1] Also of equal or more import, the faculty was successful in its effort to provide the Air Force with younger and better qualified space trained pilots. The average age in the first class was 35. For Class II of nine students, the age dropped to 33 1/2. On 1 July 1963, the maximum age at time of application dropped to 32, and the flight prerequisite was lowered from 1,500 hours to 500 hours to obtain younger pilots for space training.[2] In addition on 1 July 1963, a faculty recommendation approved by the Air Force became effective whereby the experimental test pilot course and the aerospace research pilot course were consolidated into one course of 12 months duration with a provision for graduating selected non-space pilots as experimental test pilots in six months. All of the foregoing now made it possible to run young pilots through the combined course--first the experimental test pilot phase and then the aerospace research pilot phase--and graduate space trained pilots, engineers or managers 25 to 27 years old.

Students in the combined course flew in the morning and attended classes in the afternoon in each phase of the 12 month course. Training during the

first six months was devoted to flight test of aircraft entirely with 12 weeks set aside for performance testing and 12 weeks of stability and control evaluations. Space pilot training during the second six months included aerodynamic theory, space flight mechanics, spacecraft guidance and control, propulsion, instrumentation and communication, celestial navigation, astronomy, aeronomy, bioastronautics, and life support systems. Eighteen pilots assigned to Class 63-A inaugurated the first combined experimental test pilot course and aerospace research pilot course on 1 July 1963. Class IV with 16 students assigned on 13 May 1963 graduated 20 December 1963 to end the separate aerospace research pilot course under the original dual course arrangement. The last experimental test pilot course, Class 62-C, graduated with 17 pilots on 19 April 1963.

Class IV - Aerospace Research Pilot Course Graduates

General Schriever the Air Force Systems Command commander addressed the 16 aerospace research pilots who finished Class IV on 20 December. Those graduating from the last pure aerospace research pilot course were:

USAF Captains -

Michael J. Adams
Tommy I. Bell
William J. Campbell
Edward J. Dwight Jr
Frank D. Frazier
Theodore C. Freeman
James B. Irwin
Frank E. Liethen Jr
Lachlan Macleay
James S. McIntyre
Robert K. Parsons
Alexander K. Rupp
David R. Scott
Russell J. Scott

US Navy -

Lieutenant Walter S. Smith

US Marine Corps -

Major Kenneth W. Weir

Captains Adams, Bell, Campbell, Frazier, Freeman, Irwin, Liethen, Macleay, and Parsons were assigned to the Flight Test Center the day following graduation from Class IV, and Bell, Frazier, and Liethen were assigned further to the school staff.[3]

Class 63-A, First Combined Course

Eighteen students made up the first combined experimental test pilot course and aerospace research pilot course which kicked off on 1 July 1963. They were:

USAF Captains -

Robert S. Beale
James R. Dunbar
Jerauld R. Gentry
John S. Hardy
Richard E. Lawyer
Allen G. Myers III
Charles R. Rosburg
James H. Stanley
Joseph F. Stroface
James M. Taylor

Navy Lieutenant -

Patrick Henry Jr

Italian AF Captain -

Gianpaolo Bertelli

NASA Civilian -

Ronald M. Gerdes

Lockheed Civilian -

Darryl Greenamyer

Norway First Lieutenant -

Odd Svang-Rasmussen

RCAF Flight Lieutenant -

Walter Niemy

RCAF Squadron Leader -

David P. Wightman

Netherlands First Lieutenant -

Harry H. M. van den Biggelaar

Bertelli, Gerdes, Greenamyer, Niemy, Svang-Rasmussen, van den Biggelaar, Myers, and Wightman graduated on 20 December 1963 as experimental test pilots. The remaining students continued on seeking graduation as aerospace research pilot/engineer qualified officers.

School Staff

Commandant	Col Charles E. Yeager	23 Jul 62 -
Deputy	Lt Col Thomas H. Curtis	1 Jul 63 -
Executive	Maj James A. Houlihan	24 Aug 62 -
Ch Admin Div	Lt James E. Knight	6 Aug 62 -
Asst for Plans & Ops	Maj James A. Houlihan	27 May 63 -

Ch Training R & D Div	Capt Philip E. Neale Jr	16 Jan 62 -
Fly Trng Proj Off	Capt Clifford H. Allen Jr	29 Aug 62 -
Fly Trng Dev Off	Capt Lowry G. Martin	15 Oct 62 - 22 Nov 63
Ch Aero Res Pilot Div	Lt Col Robert S. Buchanan	15 Jan 62 -
Instructors	Mr. W. G. Schweikhard	15 Dec 61 -
	Maj Arthur Torosian	15 Jan 62 -
	Maj Robert H. McIntosh	19 Jan 63 -
	Maj John Prodan	12 Jul 62 -
	Maj Jay E. Currie Jr	16 Nov 62 -
	Maj Norris J. Hanks	9 Jul 63 -
	Capt Frank E. Liethen Jr	27 Dec 63 -
	Capt Donn F. Eisele (Trfd to AFSWC upon Graduation)	18 Aug 62 - 18 Aug 62
Ch Exper Test Pilot Div	Maj George Hendrix	10 Jan 63 -
Instructors	Maj Orgle D. Godwin	20 May 63 -
	Maj Russell S. Buker	22 Oct 62 -
	Capt Walter J. Schob Jr	9 Jul 63 -
	Capt John A. Morrison	18 Aug 62 -
	Capt Tommy I. Bell	27 Dec 63 -
	Capt Frank D. Frazier	27 Dec 63 -
	F/L Rodney E. Durnin	18 Aug 62 -

Strength

	Jul	Aug	Sep	Oct	Nov	Dec
Officers	18	19	19	19	18	22
Airmen	3	3	3	3	3	3
Civilians	5	5	5	5	5	5
Students	34	34	34	34	34	11

Student strength through November represented 16 in Class IV and 18 in Class 63-A. Class IV graduated 20 December as did seven experimental test pilots of Class 63-A leaving 11 students in Class 63-A to complete the one year aerospace research pilot course sometime near mid-1964.

Aircraft and Flying Hours

Thirty aircraft as follows made up the school inventory on 31 December:[4]

AIRCRAFT	Serial #	Date Gained	AIRCRAFT	Serial #	Date Gained
NB-57E	55-4258	Oct 56	JF-104A	56-750	Jan 62
	55-4262	Oct 56	F-104A	56-754	15 May 62
	55-4267	Oct 56	NF-104A	56-756	27 Sep 61
			F-104A	56-759	15 Oct 62
T-33A	52-9425	Mar 58	NF-104A	56-760	15 Jan 62
	52-9641	Mar 58	F-104B	56-764	15 Oct 62
	52-9846	Apr 59	F-104A	56-766	15 Oct 62
	57-549	19 Oct 61		56-826	19 Aug 62
	57-567	18 Oct 61	F-104B	56-3722	1 Jan 63
	57-751	1 Sep 62		57-1304	20 Dec 61
				57-1307	22 Oct 62
TF-38	58-1195	16 Aug 62		57-1308	6 Sep 62
T-38	59-1594	27 Apr 62			
	59-1595	4 May 62	F-106A	57-238	5 Jul 62
	59-1596	27 Jun 62	F-106B	57-2519	31 Aug 62
	59-1597	3 Apr 62		57-2529	30 Jul 62
NF-101A	53-2422	27 Mar 63			

Three aircraft were dropped from the school inventory in 1963. F-104B Serial Number 57-1301 went to the Air Proving Ground Center 4 February, F-104B Serial Number 57-3721 crashed to destruction on 28 August, and NF-104A Serial Number 56-762 crashed to destruction on 10 December. Newly added to the school inventory was NF-101A Serial Number 53-2422 picked up on 27 March from Minneapolis-Honeywell after it had been modified to a variable stability trainer and F-104B Serial Number 56-3722 transferred on 1 January from the Directorate of Flight Test.

Captain David R. Scott and Captain Michael J. Adams, students in Class IV, aerospace research pilot course, were involved in the crash of F-104B USAF S/N 57-3721 on 28 August as discussed in Chapter 1 of this volume (page 54). The school commandant, Colonel Charles E. Yeager, was piloting NF-104A USAF

S/N 56-762 when it went out of control and crashed on 10 December as related earlier also in Chapter 1 (page 55).

Lockheed California Company at a cost of $5,363,322 modified three F-104As to the NF-104A configuration by adding an LR-121-NA-1 rocket engine to each and augmenting the aerodynamic controls with reaction controls for space student training at altitudes in the vicinity of 120,000 feet. Modifications also included replacement of the F-104A vertical tail with a TF-104G vertical tail, replacing the J79-3A engine with the J79-3B, and pressurizing the cockpit with nitrogen. Lockheed finished their modifications in mid-1963 and delivered NF-104A USAF S/N 56-760 to the Flight Test Center on 1 October, USAF S/N 56-762 on 26 October, and USAF S/N 56-756 on 1 November.

Meanwhile, Santa Fe Engineers, Incorporated, under contract AF 04(611)-9549 let on 22 August rushed to complete a high altitude test service and run-up facility for hydrogen peroxide and rocket fuels servicing.[5] Center fuels supply beginning on 28 October temporarily serviced the NF-104s from two 1,550 gallon servicing trucks until the facility was completed in early 1964 at a cost of $83,184 less a hydrogen tank.[6]

Class 5 modifications estimated to cost near $2 million and approved by Air Force to convert the school's two F-106B's into variable stability trainers progressed very little beyond that discussed in the previous history (page 176). The San Antonio Air Materiel Area preparing specifications to modify the two airplanes found that another $500,000 per aircraft would be needed if the school were to use its present round instrumented F-106B's.

For a time the school attempted to either swap its two assigned F-106B's for two vertical instrumented F-106B's or to obtain vertical instruments to replace the round instruments.[7] But the AMA now has decided to modify the F-106Bs in their current configuration.

In the meantime, contract AF 04(611)-9560 negotiated with Cornell Laboratories on 20 September in the amount of $71,865 provided two B-26 airplanes through a rental program to demonstrate variable stability for students.[8] The B-26's arrived in mid-October, curriculum flights began on 21 October, and the aircraft departed by 2 December to complete the program.

A program to convert the school's F-106A to produce low lift to drag ratios (variable L/D) also progressed somewhat slowly during 1963. It had been planned to use this airplane equipped with a special chute as a drag inducing device to demonstrate to students low L/D approaches and landings like those of future winged space vehicles. But 36 and 48 inch ribless guide surface parachutes tested during June and July failed to achieve the desired drag by about 30 percent, and larger chutes proved impractical because of a tendency to dip into the jet blast which disrupted chute stability and steady state drag.[9] Next attempt to meet the variable L/D requirement will be to install retractable drag plates on the F-106A missile launcher rails.

Flying hours:[10]

Jul	Aug	Sep	Oct	Nov	Dec
603:30	653:30	474:05	509:05	572:55	65:50

Static Space Simulator

Modification of the three F-104s to high altitude NF-104 trainers, conversion of two F-106Bs to variable stability trainers, and the attempt to provide a low lift to drag ratio with the F-106A all were part of a program to update technical facilities and capabilities of the Aerospace Research Pilot School. The basic program was documented under Engineering Service Project (ESP) 922A-9060 initially prepared in November 1961[11] and revised from time to time since. One of the major tasks still pending was the school's static space simulator begun 30 November 1962 under contract to the Link Division of General Precision, Incorporated, on a cost plus incentive fee price of $3,481,000 agreed to by Link. In 1963, however, the contractor ran into development problems which necessitated additional funds and it now looks as if the end item will run as high as $5 million.[12]

Construction at the school to house the static space simulator began under Corps of Engineers contract DA-04-353-Eng-8782 valued at $188,604 and bid by Santa Fe Engineers at $184,944 initially was scheduled for completion with P341 funding in the amount of $190,000. But P341 fund limitations bobbed up in July and the Director of Procurement had to assume contract administration and full responsibility for the Corps of Engineers contract. Notice to proceed went out to Santa Fe in August, and the building should be ready by April or May 1964. Static space simulator installation should begin shortly thereafter.

The static space simulator when completed will enable students to fly entire space missions in realistic simulation except zero gravity and acceleration. Responsibility for operation and maintenance of the static space simulator and static aerodynamic simulators and responsibility for technical supervision of the Link operating and maintenance contract for the whole mission space simulator have been worked out between the Flight Research Engineering Division, Directorate of Flight Test Engineering, Deputy for Systems Test, and the USAF Aerospace Research Pilot School.[13]

Dynamic Simulator (Centrifuge)

A dynamic simulator although not specifically requested in the initial ESP 922A-9060 submitted 21 November 1961 appeared as a call for study on a closed loop dynamic simulator with environmental conditioning.[14] A revision later (20 November 1962) indicated that almost $10 million earmarked for a dynamic simulator had been included in the Fiscal Year 65 military construction program.[15] But Air Force in 1963 deleted the centrifuge from the Center's FY-65 MCP in view of an offer from the National Aeronautics and Space Administration to provide the school with full centrifuge training support at the NASA Houston facility.[16] Consequently this task as an ESP 922A-9060 item was dropped for the time being by the school.

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

Mission of the USAF Aerospace Research Pilot School since 12 October 1961 has been to train selected pilots to monitor and conduct flight tests of research, experimental, or production type aerospace vehicles.[1] As seen in the immediately preceding chapter these tests were made on aerospace vehicles to determine their flight characteristics, performance, stability and control, and functional utility and to gather technical information on the serviceability and reliability of their installed equipment and components.

Originally the Aerospace Research Pilot School mission was discharged through two distinct courses: an experimental test pilot course and an aerospace research pilot course--each about seven months long.[2] On 1 July 1963, however, the two courses were combined into one aerospace research pilot course divided into two phases--an experimental test pilot phase and an aerospace research pilot phase--each approximately six months long.[3] The experimental test pilot phase trained Air Force pilots, pilots of other services and agencies, pilots of allied nations, and pilots of Air Force contractors in the latest methods of testing and evaluating aircraft and related aeronautical equipment. The aerospace research pilot phase trained selected graduates of the experimental test pilot phase as pilots and project officers for manned space research programs. Eighteen students assigned to Class 63-A inaugurated the first combined experimental test pilot course and aerospace research pilot course on 1 July 1963.[4]

Five students of the first class under the old two-course system graduated on 15 December 1961 to mark the beginning of an Air Force space training capability that to the end of 1963 made available 41 highly skilled space research pilots for the nation's aerospace projects. The National Aeronautics and Space Administration, in fact, already had selected six of the 41 space trained pilots for the nation's Gemini and Apollo programs. Aerospace research pilot course graduates by Class follow:[5]

Class I
(5 June - 15 December 1961)

Major	Thomas U. McElmurry
Major	Robert S. Buchanan
Major	Frank Borman*
Captain	James A. McDivitt*
Mr.	William G. Schweikhard

Class II
(18 June 1962 - 18 January 1963)

Major	Charles C. Bock
Major	Byron F. Knolle Jr
Major	Robert H. McIntosh
Major	Donald M. Sorlie
Major	Arthur Torosian**
Captain	Albert H. Crews Jr
Captain	Robert W. Smith
Captain	William T. Twinting
Lieut Commander	Carl Birdwell Jr (Navy)

Class III
(22 October 1962 - 31 May 1963)

Major	Tommie D. Benefield
Major	Neil R. Garland
Captain	Alfred L. Atwell
Captain	Charles A. Bassett*
Captain	Michael Collins*
Captain	Joe H. Engle
Captain	Edward G. Givens Jr
Captain	Francis G. Neubeck
Captain	James A. Roman
Captain	Alfred H. Uhalt Jr
Captain	Ernst Volgenau**

Class IV
(13 May 1963 - 20 December 1963)

Captain	Michael J. Adams
Captain	Tommy I. Bell
Captain	William J. Campbell
Captain	Edward J. Dwight Jr
Captain	Frank D. Frazier
Captain	Theodore C. Freeman*
Captain	James B. Irwin
Captain	Frank E. Liethen Jr
Captain	Lachlan Macleay
Captain	James S. McIntyre
Captain	Robert K. Parsons
Captain	Alexander K. Rupp
Captain	David R. Scott*
Captain	Russell J. Scott
Lieut	Walter S. Smith (Navy)
Major	Kenneth W. Weir (Marine)

* To NASA as astronauts.
** Attended as instructor/student.

As might be suspected from the foregoing organization chart Air Force headquarters established policy for operation of the school,[6] Air Force Systems Command was responsible for operation and supervision of the school in accordance with Air Force policies,[7] and the Air Force Flight Test Center operated the school for Systems Command.[8] Organization of the USAF Aerospace Research Pilot School at the Flight Test Center reflected clearly its training mission. Two training divisions under the school commandant were supported by an executive office and a training research and development division. The latter division functioned as project office for design, development, and procurement of special training devices needed by the school to fulfill the newly acquired space training mission.

Introduction of research pilot training into the school immediately affected manpower authorizations, aircraft assigned the school, and funds for new facilities. Headquarters USAF began actively supporting Engineering Service Project (ESP) 922A-9060 in May 1962 to update school technical facilities and capabilities.[9] By 1964 major active tasks still remaining under the ESP had been trimmed down to:

1. Space Flight Simulator.
2. F-104 with Rocket Engine and Ballistic Control Augmentation.
3. F-106B Variable Stability Trainer.
4. F-106A Variable Lift/Drag Trainer.

The school's space flight simulator which began 30 November 1962 under contract to the Link Division, General Precision, at a cost plus incentive fee price of $3,481,000 was nearing completion in late 1963 when the contractor ran into a series of development problems with the visual system (Mission Affects Projector), computer system, and moving base system. These unanticipated

problems not only delayed the date the simulator would become operational but cost another $1,440,000 at the time as well.[10] Additional overrun on the space flight simulator program through the end of June 1964 appeared to be as much as $240,000 as follows:[11]

Farrand Optical Company on the Visual system	$111,000
American Machine and Foundry on the motion system	54,000
Link Division on a portion of the visual system	74,000

An addition to the school for housing the space flight simulator was completed on 23 April by Santa Fe Engineers at a cost of $187,000 under contract DA 04-353-Eng-8782 and accepted by the Air Force on 15 May.[12]

Delivery of the third and last NF-104 to the Flight Test Center on 1 November 1963 concluded the Lockheed-California Company portion of the task: F-104s with rocket engine and ballistic control augmentation.[13] One of the three aircraft (USAF S/Ns 56-756, 56-760, & 56-762) was undergoing performance and stability tests in the Directorate of Flight Test and two were being used for instructor checkout at the school when one (56-762) at the school crashed on 10 December following a zoom maneuver.[14] Testing halted temporarily during a preliminary investigation of the accident then continued through June on the two remaining aircraft.

Class V modifications to convert two F-106Bs at the school into variable stability trainers although receiving Headquarters USAF approval slipped one year when funds for a preliminary design study were withdrawn and slipped more when the Air Materiel Area could not meet the engineering design requirement due to higher priority work.[15] The picture brightened sufficiently in early 1964 to draw up requests for proposals. But before these documents could be sent out to contractors calling for how the job would be done,

Headquarters USAF withdrew $1,200,000 funding for modification of the F-106Bs and the program slipped at least through 30 June.[16]

In-house development and testing of a high-drag F-106A to provide a subsonic low lift to drag ratio (variable L/D) was discussed already in the preceding chapter (page 100). Briefly, however, drag parachutes failed to achieve the desired L/D, and metal drag plates were attached to the F-106 missile launching rails in an effort to obtain the drag required. These drag plates seemingly provided sufficient drag to meet school training needs and could be attached to missile launching rails without major modification to the F-106.[17]

A program to instrument newly assigned T-33 and T-38 aircraft and update instrumentation of the school's B-57 airplanes added approximately $92,000 to the ESP in February 1964. That estimated cost was for parts and equipment only,[18] for Flight Test Center instrumentation personnel had been scheduled to perform the work.

Obviously all of the foregoing activity was designed to provide the school with a better facility to train research pilots for manned space flight. For Calendar Year 1964, Headquarters USAF allocated 36 aerospace research pilot spaces--30 Air Force pilots and a total of six pilots from the Navy and Marine Corps. Twelve additional spaces from the National Aeronautics and Space Administration (4), Military Assistance Program nations (6), and countries unassigned (2) were allocated as experimental test pilots.[19] The yearly allocation (36/12) worked out to three classes of 16 students each per year starting January, May, and September with the actual starting date established as the first Monday of the month in which a class started. The exception to this schedule of course was the first combined class (63-A) which began in July 1963.

Class 63-A, First Combined Class

As mentioned at the beginning of this chapter, 18 students made up the first combined experimental test pilot and aerospace research pilot course on 1 July 1963 as Class 63-A. Experimental test pilots graduated from the Class on 20 December as pointed out in the preceding semiannual history (page 153) and the remainder less Captain Allen G. Myers III who also graduated as an experimental test pilot continued on in the aerospace research pilot phase of Class 63-A. Air Force Captain William J. Knight a previous graduate of the experimental test pilot school (Class 58-C) and a member of the X-20 (Dyna-Soar) Pilot Consultant Group until the program cancelled on 10 December 1963 joined Class 63-A for the aerospace research pilot phase. Class 63-A students scheduled to graduate later in 1964 were:[20]

USAF Captains -

Robert S. Beale
James R. Dunbar
Jerauld R. Gentry
John S. Hardy
William J. Knight
Richard E. Lawyer
Charles R. Rosburg
James H. Stanley
Joseph F. Stroface
James M. Taylor

US Navy Lieutenant -

Patrick Henry Jr.

Class 64-A, Second Combined Class

The second combined class began on 6 January 1964 with 16 students as follows:[21]

USAF Captains -

Ronald V. Franzen
Ernest F. Hasselbrink
James W. Hurt III

US Navy Lieutenant -

John L. Finley
Richard H. Truly

David W. Livingston
George J. Marrett
Richard E. Strickland
David W. Thomas
Gervasio Tonini
Richard K. Voehl
Robert E. Whelan

National Aeronautics and Space Administration Civilian -

Fred W. Haise Jr
Donald L. Mallick

Netherlands First Lieutenant -

Jacob Hofstra

Royal Canadian Air Force Flight Lieutenant -

Clifford H. Wilkinson

Class 64-B, Third Combined Class

Class 64-B entered training on 4 May with the following personnel assigned:[22]

USAF Captains -

Robert F. Bernado
Thomas E. Brand
Robert D. Freeman
Charles G. Fullerton
Paul M. Jeglum
Augustine R. Letto
Robert I. McCann
Leslie D. Pruitt
Thurlow H. Ralph
Charles N. Stone

US Navy Lieutenant -

Albert H. Best III
Marle D. Hewett

Captains Brand, Letto, and McCann were dropped from the class 18 May upon recommendation of the faculty.

Manpower Authorized and Personnel Assigned

Manpower authorizations which rose dramatically with introduction of aerospace research pilot training into the school leveled out in December 1962 at 18 officers, 8 airmen, and 6 civilians. Since 1962 there has been no increase in total authorized. But the demand for additional instructors altered grade

structure until on 30 June 1964 school authorizations stood at 23 officers, 3 airmen, and 5 civilians. Three airmen and four civilian spaces were administrative and secretarial while the remainder manned the school staff and faculty. Total personnel assigned at the school by month follows:

	Jan	Feb	Mar	Apr	May	Jun
Officers	22	23	24	24	24	25
Airmen	3	2	2	2	2	2
Civilians	5	5	5	5	5	5
Students	28	27	27	27	36	36

Student strength in January reflected Captain Allen G. Myers III, of Class 63-A who departed for his new assignment in February 1964 after graduating as an experimental test pilot 20 December 1963.[23] Consequently, the 28 student total was Myers, 11 students of Class 63-A remaining, and 16 newly enrolled students in Class 64-A. The increase in May of course was the result of Class 64-B which began with 12 students but dropped to nine when three were reassigned after two weeks at the school.

School Staff and Faculty

Commandant	Col	Charles E. Yeager	23 Jul 62 -	
Deputy	Lt Col	Thomas H. Curtis	1 Jul 63 -	
Executive	Maj	James A. Houlihan	24 Aug 62 -	
Chief, Admin	Lt	James E. Knight		- 26 Feb 64
	Lt	Adam S. Brown	26 Feb 64 -	
Operations O	Capt	Robert N. Broughton	20 Jan 64 -	
Ch, R & D Tr Div	Capt	Philip E. Neale Jr		- 3 Jan 64
	Capt	Clifford H. Allen Jr	3 Jan 64 -	
Fly Tr Proj O	Capt	Clifford H. Allen Jr		- 3 Jan 64
Fly Tr Dev O	Capt	Robert L. Allison	1 May 64 -	

Ch, Aero Research Pilot Div	Lt Col	Robert S. Buchanan	15 Jan 62 -
Instructors	Mr	W. G. Schweikhard	15 Dec 61 -
	Maj	Arthur Torosian	15 Jan 62 -
	Maj	Robert H. McIntosh	19 Jan 63 -
	Maj	John Prodan	12 Jul 62 -
	Maj	Jay E. Currie Jr	16 Nov 62 -
	Maj	Norris J. Hanks	9 Jul 63 -
	Capt	Frank E. Liethen Jr	27 Dec 63 -
	Lt	Darvis W. Gaskins Jr	4 Mar 64 -
	Capt	Albert H. Crews Jr	29 Jun 64 -
Ch, Exper Test Pilot Div	Maj	George D. Hendrix	10 Jan 63 -
Instructors	Maj	Orgle D. Godwin	20 May 63 -
	Maj	Russell S. Buker	22 Oct 62 -
	Capt	Walter J. Schob Jr	9 Jul 63 -
	Capt	John A. Morrison	18 Aug 62 -
	Capt	Tommy I. Bell	27 Dec 63 -
	Capt	Frank D. Frazier	27 Dec 63 -
	Flt Lt	Rodney E. Durnin	18 Aug 62 -
	Maj	David H. Tittle	27 Jan 64 -

Aircraft and Flying Hours

Between 1 January and 30 June 1964, the school added five aircraft to its inventory and lost two in crashes.[24] T-33As USAF S/N 55-4378 and 56-3659 were picked up from Base Operations, 6510th Air Base Group, on 21 January, T-38s USAF S/N 63-8134 and 63-8135 were gained from Norair in Palmdale on 4 February, and an F-104D formerly at the Air Force Special Weapons Center was obtained from McClellan AFB where it had been undergoing inspection and repair as necessary (IRAN) and time compliance of technical order (TCTO). The two losses involved F-104Bs USAF S/N 57-1308 which crashed to destruction on 18 February and 56-764 which crashed on 15 June as discussed previously on

page 39 of this history. Aircraft in the school inventory on 30 June numbered 33 as follows:[25]

Aircraft	Serial #	Date Gained
NB-57E	55-4258	Oct 56
	55-4262	Oct 56
	55-4267	Oct 56
T-33A	52-9425	Mar 58
	52-9641	Mar 58
	52-9846	Apr 59
	55-4378	21 Jan 64
	56-3659	21 Jan 64
	57-549	19 Oct 61
	57-567	18 Oct 61
	57-751	1 Sep 62
JT-38A	58-1195	16 Aug 62
	59-1594	27 Apr 62
	59-1595	4 May 62
	59-1596	27 Jun 62
	59-1597	3 Apr 62
	63-8134	4 Feb 64
	63-8135	4 Feb 64

Aircraft	Serial #	Date Gained
NF-101A	53-2422	27 Mar 63
JF-104A	56-750	Jan 62
F-104A	56-754	15 May 62
NF-104A	56-756	27 Sep 61
JF-104A	56-759	15 Oct 62
NF-104A	56-760	15 Jan 62
F-104A	56-766	15 Oct 62
JF-104A	56-826	19 Aug 62
JF-104B	56-3722	1 Jan 63
	57-1304	20 Dec 61
	57-1307	22 Oct 62
F-104D	57-1319	17 Apr 64
JF-106A	57-238	5 Jul 62
F-106B	57-2519	31 Aug 62
	57-2529	30 Jul 62

Flying hours:[26]

Jan	Feb	Mar	Apr	May	Jun
678:20	616:20	711:30	581:00	713:45	587:20

Chapter 4

USAF AEROSPACE RESEARCH PILOT SCHOOL

Since 12 October 1961 when the Air Force Secretary redesignated the USAF Experimental Flight Test Pilot School as the USAF Aerospace Research Pilot School,[1] the school mission has been one of training selected pilots to monitor or perform flight test of research, experimental, or production type aerospace vehicles.[2] Two courses of study, an experimental test pilot course and an aerospace research pilot course, were the means by which the mission was accomplished. Air Force Headquarters published a new regulation (AFR 53-19) to spell out what each course would include in its curriculum. In addition, the new regulation set forth eligibility requirements to be met for attending the courses, how to apply for attendance, and what type assignment to expect when graduated.

Eventual need for an aerospace course in the school was first conceived in 1959 when two instructors, Mr. William G. Schweikhard and Captain Edward G. Givens Jr., began kicking the idea around. But the two instructors channeled their thinking into "up-dating the existing experimental test pilot course" because the space training concept was so new and so hard to sell.[3] Even the school commandant, Major Richard C. Lathrop, failed at first to comprehend the significance of

introducing aerospace training into the school. By late 1959, however, Captain Givens and Mr. Schweikhard convinced the commandant that the Air Force one day would have need for a space mission and would require aerospace trained pilots.

Once on the space pilot training merry-go-round, Major Lathrop went all-out despite the adversities, and before the end of 1959, he called in an old friend, Major Thomas U. McElmurry, to join Mr. Schweikhard and Captain Givens to get the space training portion of the school off the ground. McElmurry at the time was project engineer on the Sidewinder supersonic, guided, air-to-air missile at Holloman Air Force Base where he had been since graduating on 1 October 1956 with Class 56-B, USAF Experimental Flight Test Pilot School. His academic qualifications to tackle the job laid out by Major Lathrop included a bachelor degree in petroleum engineering from the University of Alabama and a masters in aeronautical engineering from the University of Michigan.

Major McElmurry joined the school faculty at the beginning of 1960 and teamed with Major Lathrop, Mr. Schweikhard, and Captain Givens to lay the foundation for introduction of an aerospace research pilot course into the USAF Experimental Flight Test Pilot School. Academically the four provided exceptional depth for the task at hand. Major Lathrop graduated from the University of Wisconsin with bachelor of science,

master of science, and doctor of philosophy degrees. Moreover, he graduated 6 April 1956 with Class 55-D, USAF Experimental Flight Test Pilot School. He joined the school faculty immediately as Chief of the Operations and Training Branch and had served in that capacity until becoming school commandant 29 June 1959. Mr. Schweikhard held a bachelor degree in engineering from the University of California at Los Angeles and a masters in mechanical engineering from the University of Southern California. He had been assigned to the school faculty from the Flight Test Engineering Division, Directorate of Flight Test, in April 1959 to modernize the curriculum which had become stagnant as a result of the supersonic jet age. Captain Givens, a 1952 United States Naval Academy graduate, came to the school as a student in Class 58-B. He graduated on 2 October 1958 and remained at the school as stability and control instructor. Major McElmurry, Captain Givens, and Mr. Schweikhard then became the three individuals who worked hardest to promote a space course at the school, and of the three, Major McElmurry became the one individual most responsible for introducing the first aerospace research pilot course into the school.

McElmurry first as Chief of the Operations and Training Branch and later as Special Assistant to the Commandant bent all his energies towards adding an aerospace research pilot

course to the school. He discarded the old concept of "up-dating the existing test pilot course" which originated earlier with Captain Givens and Mr. Schweikhard and went from the bottom up through the Air Force hierarchy trying to sell a separate aerospace course. McElmurry and Schweikhard (Captain Givens went TDY 18 months exchange duty with the US Navy in 1960) travelled extensively in 1960 often without per diem seeking Air Force support for their space course. But few would listen for the Air Force had not yet come up with a space mission.

Somewhat dismayed after numerous rebuffs and exceedingly little support locally McElmurry and Schweikhard solicited assistance of the school faculty to prepare a case for training space pilots. By October 1960 the three had assembled several detailed staff studies setting forth facility expansion needed and training aids required. It was, in fact, one of those studies staffed by McElmurry, Schweikhard, and Major Frank Borman who had joined the space training team in late 1960 that was credited with partially selling Air Force Headquarters on the space trained Air Force pilots idea.[4]

Unfortunately Air Force's nod of approval to add a space course to the school was premised upon the need of very little support for facility expansion. Nevertheless, Air Force Systems Command in conjunction with the Center decided to go

it alone as an in-house effort and the school commandant, Major Lathrop, in late 1960 was given the go-ahead. On 1 January 1961, Major Lathrop named Major McElmurry as his special assistant[5] to prepare a curriculum for an aerospace research pilot course.

Major McElmurry faced preponderant problems in starting a class of new instruction on such short notice and without definitized backing. The USAF Experimental Flight Test Pilot School lacked personnel authorizations for the new course and did not have space instructors had they been authorized. Moreover, school funds were critically short, and to make matters worse space training devices which were not available at the school even to a small degree were either located great distances from the school or not available.

But Majors McElmurry and Borman and Mr. Schweikhard working day and night for ever so long now began to toil harder. Again they travelled frequently without reimbursement ranging far and wide seeking support only this time it was requested of various contractors and educational institutions since they lacked full Air Force backing. They arranged with contractors and the Navy to provide use of space simulation facilities and training devices. Additionally at several universities they obtained special aerospace instruction for a limited number of students.

eager participated in the graduation ceremonies.

Finally on 5 June 1961, Class #1, Aerospace research pilot course began due mainly to the dedication and devotion of the school faculty who saw a need for Air Force aerospace pilot training. Majors McElmurry and Borman and Mr. Schweikhard were instructor/students of that first class which was designed by the three to develop instructor competency and pave the way facility-wise for future courses.[6]

Besides McElmurry, Borman, and Schweikhard, that first class of five students included Captain James A. McDivitt of the Flight Test Operations Division, Directorate of Flight Test, and Major Robert S. Buchanan who joined Class #1 on 19 September 1961 direct from the University of Michigan where he obtained a doctorate in Astronautics.

The five students of the first aerospace research pilot course graduated in ceremonies on 15 December. Major McElmurry left immediately for the Air Command and Staff College, and the space training workload he had carried so long shifted to Major Buchanan, Special Assistant for Aerospace Training to Lieutenant Colonel Robert M. Howe who had replaced Major Lathrop in mid-1961.[7] Major Arthur Torosian joined Major Buchanan and Mr. Schweikhard in early 1962, and the three settled down to put together a course of study and establish cost figures for a second aerospace research pilot course.

Significantly, Class I had been designed to develop instructor competency and to determine what the school needed to update its facilities for introduction of aerospace research

pilot training. While the first class was in session, Captain Philip E. Neale, a member of the faculty, prepared an Engineering Service Project (ESP) using the staff studies of 1960 as augmented by what Class #1 found the school needed to expand its capability. The finished document (ESP922A-9060) setting forth facility and fund requirements was approved at Air Force Systems Command on 21 November 1961.[8] It called for a Class of eight students in 1962, eight in 1963, 12 in 1964, and 15 in 1965, based on Air Force funding and Center support.[9] Before Captain Neale finished his ESP however, a school recommendation to redesignate the school as the USAF Aerospace Research Pilot School[10] had been accepted by the Air Force on 12 October 1961,[11] and Air Force Headquarters even published a new regulation covering operation and supervision of the USAF Aerospace Research Pilot School.[12] But Air Force recognition given the school so far only meant in effect that the school now had the space training mission ball and was supposed to run with it. However this was the first firm indication that the Air Force intended to go after space mission roles even though nothing yet had been done to provide training facilities and funds so essential to the success of training envisioned by the school faculty.

The extent to which the newly introduced space course would be a success was contingent also upon the amount of

support the Center would provide the school. The first class as already noted was in-house within the school and conducted for and by members of the school with exception of Captain McDivitt. It was obvious to all concerned in early 1962 that an aerospace research pilot course for eight students would require a great deal of facility and fund support beyond the school's capability. Seemingly, however, Center support like Air Force support failed to meet the schools requirements. The school commandant, Colonel Howe, aptly demonstrated his concern in February 1962 when he informed a Center official: ". . . there now exists within AFFTC a great deal of built-in, self-generated headwind with respect to getting behind the Aerospace Research Pilot School and giving it forceful, vigorous Center support. . . ."[13]

Nevertheless, top Center officials never became completely aware of the space course dilemma until late in the spring of 1962 when it was fully aired before General Branch and his chief of staff, Colonel Ray Vandiver. Colonel Howe, the school commandant somehow finagled a hearing before an Air Force Ad Hoc committee in Washington on what the school needed support-wise for a second space course and had solicited the help of the Center commander and his chief of staff to plead the school's case. During the presentation, Colonel Howe, Major Buchanan, Major Torosian, and Captain Neale with some

concern to the two Center officials openly and frankly discussed a lack of support both from the Center and the Air Force.[14]

Just what all was achieved by that trip to Washington was not too clear. But not long afterwards, Air Force Headquarters began to actively support the Engineering Service Project to update school facilities and directed a May class of eight space students be expeditiously supported at all levels. In May, moreover, Air Force Headquarters seemingly overnight decided to form a pool of space pilots not only for coming Air Force needs but for the National Aeronautics and Space Administration as well.[15] Under a crash program Air Force wanted besides the eight students as Class II, another 10 to begin in September as Class III and 16 more to start early in 1963 as Class IV. Figures hastily thrown together at the school indicated costs of a second class (Class III) in 1962 set up on a minimum acceptable basis would exceed $2 million.[16] Immediate impact of all this: manpower authorizations for the school more than doubled, aircraft assigned the school jumped from 19 to 31 in six months,[17] and more than $10 million was placed at the schools disposal to update its technical facilities.[18]

Authorization for and acquisition of technical facilities to update the school obviously were two different matters,

but a start was underway locally to fill the gap. Center personnel were fabricating from materials obtained locally an interim static simulator, a ballistic control simulator, an orbital rendezvous simulator, and instrumenting three F-104's for the start of Class II in May.[19] Captain Neale, project officer on the Center's in-house effort, as late as February 1962 anticipated no major difficulty in finishing his work by the time Class II would have need of the simulators and newly instrumented F-104's.[20]

Class II's starting date of 14 May still looked firm in March.[21] But a series of adverse events overtook school planners in the end and the starting date slipped to 18 June.[22] One of the major setbacks occurred when Lieutenant John Davis. an electrical engineer assigned to the Computer Section, Flight Research Branch, Flight Test Engineering Division, Directorate of Flight Test, rewiring an F-106 cockpit as an interim static simulator separated from the Air Force in May 1962 leaving the Center without a capability to complete the module. The remainder of the module then had to be contracted out to Hughes Aircraft at $40,000 and never was finished until September 1962.[23] Lack of simulation and instrumented F-104's also slipped Class III with 10 students from a September starting date to 22 October. But in the end and with the aid of Center support, an interim static simulator,

a ballistic control simulator, and an orbital rendezvous simulator, as well as several specially instrumented F-104 aircraft were available for space course student use.

The interim static simulator valued at $800,000 dollars built locally from a salvaged F-106 cockpit (fully instrumented) cost about $200,000 for parts and $50,000 for labor.[24] Initially, some simulations were hampered by difficulty between the antiquated Goodyear Electonic Data Analyzer (GEDA) computer and the F-106 cockpit and a few computer breakdowns.[25] By year's end, however, a new PACE 231R computer had been added and students received attitude control simulations, variable stability simulations, X-20/Apollo Re-entry, boost simulations and orbital rendezvous.

The ballistic control simulator built at a cost of $20,000 from salvaged material and local manufacture[26] provided students trouble-free reaction control simulations. But addition of F-104's to the school brought on aircraft spares support problems which became critical particularly in the supply of tires and main landing gear actuators.[27] Nevertheless, both the experimental flight test pilot course and the aerospace research pilot course Classes II and III in session during the interim proceeded without excessive interference.

Besides the work of Captain Neale and Mr. Schweikhard, a good share of credit for starting an additional class (III)

as soon as 22 October 1962 belonged to Major McElmurry who returned from the Air Command and Staff College 15 July 1962 and became Deputy Commandant.[28] Another factor of considerable significance was assignment of Colonel Charles E. Yeager as Commandant on 23 July 1962.[29] Colonel Yeager had been Deputy Director of Flight Test, the one organization that most closely associated with support of the school's simulation program and the main source of its additional F-104 aircraft.[30]

Primarily, however, responsibility for setting up Class III rested with Major Buchanan who had become Chief of the Aerospace Research Pilot Divisionon 15 January 1962.[31] Academically Major Buchanan was exceptionally qualified to head up the Aerospace Research Pilot Division. Since graduating from high school at Alhambra, California, in 1943 he had obtained electrical and aeronautical degrees and a PhD in astronautics. He was an experienced test pilot having participated in F-89, F-100, F-102, and F-104 flight test programs and he was a graduate of the former USAF Experimental Flight Test Pilot School and Class I, aerospace research pilot course as noted previously. As a student in the latter course, moreover, Major Buchanan played a big part in shaping the curriculum for subsequent aerospace research pilot courses.

As soon as Class III had jelled, Colonel Yeager directed the efforts of Majors McElmurry and Buchanan, Captain Neale, and Mr. Schweikhard towards consolidation of the experimental test pilot and aerospace research pilot courses into a single training program. The staff on 9 November 1962 came forward with an ambitious program designed to provide the school with younger, better qualified candidates for instruction beginning on 1 July 1963.[32] They proposed to gear the school to graduate 54 space trained pilots and 18 experimental test pilots annually. By combining the two courses into a one year course split into two phases each of six months duration it would be possible to drop out those students (NATO and other than US pilots) not required to become aerospace research pilots.

The staff proposed also to lower entrance requirements for schooling and they revised the curriculum to include flight training in reaction control and weightlessness during the aerospace course. The study which included the reasons for combining the two courses, the course structure, student output, training resources needed, class schedules, and a proposed revision to AFR 53-19 received quasi-approval verbally in early 1963 and became official on 1 May with publication of a new AFR 53-19. However, USAF limited the school's production rate to 36 aerospace trained pilots and 12 experimental test pilots rather than the 54/18 requested.[33] USAF

did indicate though that the USAF Aerospace Research Pilot School should be kept flexible in order to expand rapidly if the need arose.

An Engineering Service Project to update school facilities had been actively supported by USAF since May 1962 as already noted. Prime projects yet remaining in 1963 which would update the school capability to a level commensurate with its new aerospace research pilot training mission included modification of three F-104's to provide rocket augmentation, converting two F-106's to variable stability flying classrooms and one F-106 to a variable lift/drag training aid, and construction of a static space simulator. The latter facility had been underway since 30 November 1962 when the Link Division of General Precision, Incorporated, signed a letter contract with Aeronautical Systems Division for $1.7 million. But this only partially funded the simulator to be built under a cost plus incentive fee contract tagged at $3,481,000.[34] Therefore, another $1.8 million AFFTC obligation authority went to ASD on 18 January 1963 to fund the simulator.

Another $190,000 in P-341 construction funds became available in 1963 to house the simulator at the school. Architectural and engineering effort for building design began early in 1963 and on 25 June bids opened at the Corps of

Engineers in Los Angeles with the contract going to Santa Fe Engineers for $184,944. Construction completion date would be sometime near 1 February 1964.

In the meantime, school officials became alarmed over additional F-104 aircraft for Class IV aerospace research pilot course which began on 13 May as the last class prior to consolidating that course with the experimental test pilot course. Three additional F-104's seemingly were needed by 1 July 1963 to meet requirements imposed by 16 students of Class IV. Headquarters AFSC having been notified upon several occasions in early 1963 that the F-104 aircraft requirement had become critical found it impossible to provide relief from available allocations even on an interim basis, for USAF refused additional allocations and even suggested greater utilization on F-104's already on hand. School officials at first threatened to cut Class IV from 16 to 12 students. But by 30 June an in-house plan had been devised which involved decreasing student and instructor flying time to a bare minimum and increasing management of maintenance and supply support to reduce F-104 down time.

Final Experimental Test Pilot Course Graduates

Seventeen pilots graduated 19 April 1963 as Class 62-C, the last experimental test pilot course, which began 27 August 1962. Secretary of the Air Force Eugene M. Zuckert addressed

the Class during graduation ceremonies for the 11 Air Force pilots, one civilian pilot, and five fliers from allied nations. Graduates and their assignments follow:

USAF Captains to aerospace research pilot course Class #IV -

Michael J. Adams	Robert K. Parsons
William J. Campbell	Alexander K. Rupp
Edward J. Dwight Jr.	David R. Scott
James S. McIntyre	Russell J. Scott

USAF Captains to other commands -

Edward G. Flanigen	- -	Air Force Flight Test Center
Robert L. Jondahl	- -	Air Proving Ground Center
Robert B. Tanguy	- -	Tactical Air Command

Mr. Bruce A. Peterson returned to NASA's Flight Research Center at Edwards AFB while the five Air Force Captains of allied nations returned to their home countries as follows:

Italy	-	Alessandro Ghisleni and Italo Tonati
Japan	-	Shunkichi Negishi and Hideo Ogawa
Netherlands	-	Hendrix N. Themmen

Aerospace Research Pilot Course Graduates

Mr. Lee Atwood, Chairman of the Board, North American Aviation, Incorporated, addressed nine graduates of Class II, aerospace research pilot course, at ceremonies held 18 January 1963. Graduate Lieutenant Commander Carl Birdwell Jr., returned to the Navy, USAF Major Byron F. Knolle Jr., went to Space Systems Division, and the remainder (all USAF) as follows were assigned to the AFFTC:

Majors Charles C. Bock Jr., Robert H. McIntosh, Donald M. Sorlie, and Arthur Torosian (instructor/student), and Captains Albert H. Crews Jr., Robert W. Smith, William T. Twinting.

Dr. W. Randolph Lovelace, head of the Lovelace Clinic in Albuquerque was principal speaker when Class III of the aerospace research pilot course graduated 11 pilots on 31 May. Graduates assigned to the AFFTC were:

> Major Tommie D. Benefield and Captains Charles A. Bassett, Michael Collins, Joe H. Engle, Edward G. Givens Jr., James A. Roman, and Ernst Volgenau (instructor/student).
>
> Others were:
>
> Major Neil R. Garland to Air Force Special Weapons Center, Captain Alfred H. Uhalt Jr., to the Air Force Missile Development Center, and Captains Alfred L. Atwell and Francis G. Neubeck to the Air Proving Ground Center.

Class IV, Aerospace Research Pilot Course

Sixteen test pilot students enrolled in the last purely aerospace research pilot course on 13 May. Eight of the 16 were newly graduated from the final experimental test pilot course as mentioned previously. Students enrolling in Class IV besides the eight from Class 62-C were USAF Captains:

Tommy I. Bell	James B. Irwin
Frank D. Frazier	Frank E. Liethen Jr.
Theodore C. Freeman	Lachlan Macleay

Also, Navy Lieutenant Walter S. Smith and Marine Captain Kenneth W. Weir.

The first combined experimental test pilot course and aerospace research pilot course will begin 1 July 1963 as Class 63-A. Eighteen students have been selected and approved by Headquarters USAF.

Yeager participated in the graduation ceremonies.

Strength

	Jan	Feb	Mar	Apr	May	Jun
Civilians	6	6	6	6	5	5
Students	27	27	27	10	16	16

Aircraft and Flying Hours

School aircraft remained the same as listed in the previous semiannual Center history (page 164) except F-104B USAF S/N 57-1301 was lost to the Air Proving Ground Center 4 February 1963, and JF-104B USAF S/N 56-3722 was transferred to the school from chase in the Directorate of Flight Test on 1 January and NF-101A USAF S/N 53-2422 was picked up from Minneapolis-Honeywell 27 March 1963 after modification to a variable stability trainer. Receipt of the NF-101 raised the school aircraft inventory to 32 airplanes--three NB-57's, six T-33's, five T-38's, 14 F-104's three F-106's and one F-101.

Three of the F-104's since August 1962 were in process of modification to NF-104's by including LR121-NA-1 rocket engine augmentation and reaction controls for operating at altitudes in the vicinity of 120,000 feet. First of these aircraft modified by the Lockheed California Company arrived at Lockheed's flight facility in Palmdale, California, 23 April 1963, and all three were undergoing ground tests in

Palmdale by June. First flight without power had been scheduled for early July and the first rocket powered flight would follow in late July. Total contractor cost for modification of the three F-104's was estimated to exceed $5 million.[35] Meanwhile, the school had paved the way for special servicing and run-up facilities required for the NF-104's 23 January 1963 and $124,800 had been allocated for construction under contract AF04(611)-9549.

Programmed modification of two F-106B's to provide variable stability classrooms hit a funding snag early in 1963 when Air Materiel Area prepared specifications for modification proved unsuitable and additional study by contract became necessary. But additional study to come up with a suitable design which would satisfy the variable stability mission would run in the neighborhood of $25,000. Initially, USAF had authorized $80,000 in FY-1963 for the preparation of specifications. Later, however, the school had been directed not to obligate that money until the following year. Finally and to avoid unnecessary delay, the AFFTC comptroller reprogrammed $25,000 of AFFTC money to the school and F-106 variable stability engineering specifications got underway by contract on 8 April.

Flying Hours:[36]

Jan	Feb	Mar	Apr	May	Jun
588:50	519:35	473:10	438:45	433:10	308:15

Chapter 4

OPERATIONS: USAF AEROSPACE RESEARCH PILOT SCHOOL

Since 12 October 1961 when the Air Force Secretary redesignated the USAF Experimental Flight Test Pilot School as the USAF Aerospace Research Pilot School,[1] the school mission has been one of training selected pilots to monitor or perform flight tests of research, experimental, or production type aerospace vehicles.[2] Two courses of study, an experimental test pilot course and an aerospace research pilot course, were the means by which the mission was accomplished. Air Force Headquarters published a new regulation (AFR 53-19) to spell out what each course would include in its curriculum. In addition, the new regulation set forth eligibility requirements to be met for attending the courses, how to apply for attendance, and what type assignment to expect when graduated.

Organization

The aerospace research pilot course was introduced into the school on 5 June 1961 prior to redesignation of

the school on 12 October. Concurrently with introduction of the new course, the school was reorganized to facilitate presentation of two courses instead of one. The former Training and Operations Branch with its two elements--a performance and stability section and a personal equipment section[3]--was reorganized under the Commandant as three Divisions, the Aerospace Research Pilot Division, a Support Division, and the Experimental Test Pilot Division with two branches, performance and stability and control. When the USAF Experimental Flight Test Pilot School became the USAF Aerospace Research Pilot School on 12 October, an Administrative Division and a Training Research and Development Division were added but not authorized officially. The two interim divisions became official operating functions on 8 January 1962 and were approved by Air Force Systems Command on 16 July when that headquarters accepted the school reorganization. But as noted on the organizational chart which accompanies this narrative, organization changed again on 1 August with deletion of the Support Division when its functions transferred to the Base Equipment Management Office (BEMO).

USAF AEROSPACE RESEARCH PILOT SCHOOL - 5700001 - Trains Experimental Flight Test Officers and Aerospace Research Pilots. Establishes and implements training policies and schedules. Defines requirements and develops training techniques for the training of research pilots.

AEROSPACE RESEARCH PILOT DIVISION - 5700001 - Conducts the Aerospace Research Pilot Course. Provides academic and flight instruction to qualify crew members for advanced manned aerospace vehicles.

EXPERIMENTAL TEST PILOT DIVISION - 5700001 - Conducts the Experimental Test Pilot School.

PERFORMANCE BRANCH - 5700001 - Provides academic and flight instruction in the Performance Phase of the Experimental Test Pilot Course.

STABILITY BRANCH - 5700001 - Provides academic and flight instruction in the Stability and Control Phase of the Experimental Test Pilot Course.

SUPPORT DIVISION - 5700003 - Provides mission support, aircraft dispatch, and maintains flight records.

ADMINISTRATIVE DIVISION - 5700001 - Provides administrative services including records management, preparation of administrative reports, registrar service, publication distribution, and graphics. Operates School field library. Prepares charts, graphs, slides, and other training aids in support of the School mission. Operates visual aids devices in classroom and maintains School film library.

TRAINING RESEARCH AND DEVELOPMENT DIVISION - 5700001 - Provides project management for research and development projects assigned to the School. Prepares, coordinates, and implements project documentation to continually up-date the School's technical facilities and capabilities to meet established training requirements.

Engineering Service Project 922A-9060 approved 1 November 1961[4] for updating technical facilities of the school provided the wherewithal to meet demands brought on by rapid expansion which followed introduction of the aerospace research pilot course. Manpower authorizations for the school more than doubled in 1962, and there was considerable fall-out into other units which supported school aircraft and simulation,[5] aircraft assigned the school jumped from 19 on 30 June to 31 by the end of the year,[6] and better than $10 million was marked for space simulation, new space equipment, and aircraft modifications (rocket augmentation and variable stability) for Fiscal year 1963.[7] And more was to come, for Air Force Headquarters called upon the school commandant, Colonel Charles E. Yeager, to increase student output in Calendar Year 1963.

The Engineering Service Project as approved on 1 November 1961 was revised on 20 November 1962 and approved as written. During the year preceding the revision, four of the original tasks were completed and three were deleted.[8] Two new tasks, an interim variable stability NF-101A and a dynamic simulator (centrifuge), were added by the revision of November 1962 to the six tasks remaining of the original 13. The eight tasks remaining follows:

1. Static Space Simulator
2. Dynamic Simulator
3. F-104A with Rocket Augmentation and Ballistic Controls
4. Variable stability F-106B
5. Interim Variable Stability NF-104A
6. Variable L/D F-106
7. F-104 Stability Instrumentation
8. Space Trainer Study.

Addition of a Training Research and Development capability to the school organization on 16 July was one of the four tasks completed. The remaining three were adding to the school capability an interim static simulator, a ballistic control simulator, and several F-104 aircraft. Interim static simulator support of the school fell to the Flight Research Branch, Flight Test Engineering Division, Directorate of Flight Test. The simulator valued at about $800,000 dollars was built locally from a salvaged F-106 cockpit (fully instrumented) at a cost of $200,000 for parts and $50,000 for labor.[9] Initially, some of the simulations were hampered by difficulty between the antiquated Goodyear Electronic Data Analyzer (GEDA) computer and the F-106 cockpit and a few computer breakdowns.[10] By year's end, however, a new PACE 231R computer was added and students received altitude control simulations, variable stability simulations, X-20/Apollo Re-entry, boost simulations, and orbital rendezvous.

The ballistic control simulator built at a cost of $20,000 from salvaged material and local manufacture[11] provided students trouble-free reaction control simulations. But addition of F-104's to the school brought on aircraft spares support problems which became critical particularly in the supply of tires and main landing gear actuators.[12] Nevertheless, both the experimental flight test pilot course and the aerospace research pilot course classes in session during the interim proceeded without excessive interference.

Experimental Test Pilot Course

Class 62-A which began 3 January with 16 students graduated 17 August in ceremonies high-lighted by General Branch presenting the diplomas and awards. Captain Charles A. Bassett II won the A. B. Honts Award as the outstanding student and the Empire Test Pilot School Award for his academic achievement. The H. M. Ekeren Award for exceptional flying ability went to Captain Alfred L. Atwell. Graduates and their assignments were:[13]

Air Force Flight Test Center

Captain Charles A. Bassett II	Captain Russell S. Buker
Captain Theodore C. Freeman	Captain Gene E. Hamman

Captain John A. Morrison
Captain Gay E. Jones
Flight Lieutenant Rodney E. Durnin

Aeronautical Systems Division

Captain Alfred L. Atwell
Captain Jimmie R. Hall
Captain William D. Eastman Jr.

Royal Canadian Air Force

Flight Lieutenant Earl J. Sinnett
Flight Lieutenant James R. Sutherland

Tactical Air Command — Captain Lawrence F. Gardener

Air Force Special Weapons Command — Captain Donn F. Eisele

Air Proving Ground Center — Captain Charles D. Roby

Japanese Navy — Lieutenant Yutaka Asakura

Class 61-B and Class 62-B were deleted from the 1961 and 1962 schedule after introduction of the aerospace research pilot course because of limited facilities and conflicting schedules. Class 62-C began 27 August with 17 students as follows:[14]

United States Air Force Captains

Michael J. Adams	William J. Campbell
Edward J. Dwight Jr.	Edwin G. Flanigen
Robert L. Jondahl	James S. McIntyre
Robert K. Parsons	Alexander K. Rupp
David R. Scott	Russell J. Scott
Robert B. Tanguy	

Italian Air Force Captains

Alessandro Ghisleni	Italo Tonati

Japan

Captain Shunkichi (AF)	Lieutenant Hideo Ogawa (Navy)

Netherlands Captain Hendrich N. Themmen

National Aeronautics and Space Administration

Mr. Bruce A. Peterson

Aerospace Research Pilot Course

Class I of the newly introduced aerospace research pilot course began 5 June 1961 and graduated five students 15 December 1961.[15] Class II began 18 June 1962 with eight students as noted in the previous semiannual Center history[16] and would finish in mid-January 1963. In the meantime, Class III began on 22 October 1962 with 10 students as follows:

United States Air Force Majors

Tommie D. Benefield	Neil R. Garland

United States Air Force Captains

Albert L. Atwell	Edward G. Givens Jr.
Charles A. Bassett	Francis G. Neubeck
Michael Collins	James A. Roman
Joe H. Engle	Alfred H. Uhalt

Major Frank Borman, Captain James A. McDivitt, and Captain Thomas P. Stafford were selected by Air Force Headquarters for assignment to the Gemini and Apollo programs. Borman and McDivitt graduated from both the experimental test pilot course and aerospace research pilot course. The three Center test pilots were selected by the Air Force Astronaut Screening Board from seven who volunteered to join the National Aeronautics and Space Administration's Manned Space Flight Program. Others volunteering from the Center were

Captains Michael Collins, Joe H. Engle, Neil R. Garland, and Francis G. Neubeck.[17] Borman, McDivitt, and Stafford joined the Mercury astronauts in September 1962.

Completion of aerospace research pilot course Classes II, III, and IV, and experimental test pilot course 62-C in 1963 will end the era of two separate courses which was inaugurated in June 1961 with introduction of the aerospace research pilot course.

Student flow will be revamped entirely next year. Beginning on 1 July, the aerospace research pilot course and the experimental test pilot course will be combined into a one year course. The latter will be split into two phases each of six months duration which will permit drop out of those students (NATO & other than U. S. Military pilots) not required to become aerospace research pilots. In effect as now planned, classes of 16 students will begin every four months, at least four of the 16 will graduate in six months as experimental test pilots, and the remainder will attend an additional six months to become aerospace research pilots.[18]

Chapter 3

USAF AEROSPACE RESEARCH PILOT SCHOOL

The mission of the USAF Aerospace Research Pilot School (ARPS) at Edwards AFB was spelled out in an Air Force Regulation:[1]

> *The USAF Aerospace Research Pilot School trains selected officers to monitor or perform flight tests of research, experimental or production type aerospace vehicles. These tests are made to determine flight characteristics, performance, stability, and functional utility, and to obtain technical information on serviceability and functioning of installed equipment and component parts.*

The commander of the Air Force Systems Command was charged with the responsibility for operation and supervision of the school. This responsibility was, however, delegated to the commander of the Air Force Flight Test Center.[2]

As this period of history opened, the Training, Research and Development Division of the school listed the following titles as active tasks:[3]

1. Static Space Flight Simulator
2. F-104A with Rocket Engine and Ballistic Control
3. Variable Stability F-106B
4. Space Trainer
5. MOL Support for SSD (Space Systems Division)
6. F-104 Zoom Modification
7. F-104 Side-stick Control Modification
8. V/STOL Pilot Training

Static Space Flight Simulator:

The T-27 Space Flight Simulator was accepted by the Air Force with the exception of the Mission Effects Projector (MEP) of the Visual System. The MEP to be installed in the T-27 was a modified version of the NASA Apollo MEP and, consequently, the Air Force was required to wait until

the NASA Apollo requirements had been filled. The first available date was projected to be April; 9 May was the next date, and 7 June the MEP was accepted with installation to be made during September 1966.

F-104 with Rocket Engine and Ballistic Control:

Programed to provide rocket power and ballistic control augmentation, experience under zero "G" conditions, and training in energy management and re-entry corridor techniques, the F-104 with rocket engine and ballistic control augmentation (known as the NF-104 following modification by Lockheed) appeared to be plagued with trouble.[4] The NF-104, serial number 56-756, was still at Lockheed for repairs following major damage 18 June 1965.[5] The aircraft's Reaction Control System Hydrogen Proxide plumbing was being modified; at first this modification was to make use of flex lines throughout the system, but this was changed to consist of a solid steel line from the wing root to wing tip, and a flex line from the wing root to the overhead tee. These lines would replace slip joint connections originally in use. Under the same modification, a jettison system was to be installed in each wing tip.

Variable Stability F-106B:

After considerable delay, following receipt of proposals from four companies for the modification of two F-106Bs to provide the school with a variable stability trainer capability, a contract was awarded to Martin Company of Baltimore, Maryland. The modification was expected to be completed in approximately 24 months.

Space Trainer:

A qualitative operational requirement (QOR) was established in 1961 for a trainer similar to an X-15, and updated annually, which would provide piloted boost, space altitude control and zero "G", re-entry, approach and landing, and environmental and personal equipment training.[6] At the close of this reporting period the QOR was at Hq USAF.

MOL Support for Space Systems Division (SSD):

Certain phases of flight crew training for MOL (Manned Orbiting Laboratory) was delegated to the AFFTC in a memorandum of understanding between SSD and AFFTC 15 September 1964. The USAF Aerospace Research Pilot School was named to provide the training covered by the memorandum. Two F-104B and two T-38 aircraft were provided for this flying training. The two T-38s were scheduled to be returned to Air Training Command (ATC), 1 August 1966 and two replacements were to be provided from T-38s bailed to Lockheed-Georgia. These bailed aircraft were flown only 35 hours during the past year and were reputed to have many outstanding TOCs.

The first class for MOL training by the ARPS began 7 February and was comprised of three Air Force majors, three Air Force captains, and two Navy lieutenants, and included: 66

Maj	Michael Adams	Maj	Albert H. Crews
Maj	James M. Taylor	Capt	Richard E. Lawyer
Capt	Lachlan Macleay	Capt	Francis G. Beubeck
Lt	John L. Finley (USN)	Lt	Richard H. Truly (USN)

The class was scheduled to graduate 1 August 1966.

F-104 Zoom Modification:

Objective of this modification was to reduce hazards to F-104 Energy Management flights. The background for this modification program was covered in the previous AFFTC historical report.[7] As of the end of January, the engine by-pass flap modification was completed on several of the seven aircraft. Other modifications to be made as a result of T. O. 1F-104-913 were awaiting parts. During March it was learned that the engine overtemp system would be modified for use in the F-104s by the Avien Corporation of New York.

F-104 Side-stick Controller Modification:

A contract was awarded Douglas Aircraft Company for the development and delivery of two F-104B side-stick control system modification kits, plus technical data and engineering services. The kits, when received, will be installed by AFFTC Deputy for Maintenance. The original delivery schedule was for February, however the contractor claimed a slippage of four to six months in this schedule due to technical difficulties. As of 25 May, it was reported the delivery date had slipped to January 1967.[8]

One of the technical problems was associated with the main servo drive unit, this was tentatively solved by changing from electrical servos to hydraulic servo drives. Indications were that system performance requirements would be met with the revised approach.[9]

V/STOL Pilot Training:

The background for this program was fully explained in the previous historical report.[10] A joint ASD/AFFTC Program Change Plan (PCP) and

Staff Study for a V/STOL trainer for the Aerospace Research Pilot School was approved by Hq AFSC (apparently during January) and submitted to Hq USAF where it was to be staffed. There was no report of further action during the remainder of this reporting period.

Training Classes:

Class 66-A entered training 8 January with 15 members; eleven were Air Force officers, two were Navy officers, one was an officer of the Italian Air Force, and one was a civilian with the German Air Force. Names, rank and service connection are listed below:

Napoleone Bragagnolo	Captain	Italian Air Force
William R. Casey	Lieutenant	US Navy
George W. Goodwin	Captain	US Air Force
Alan B. Hale	Captain	US Air Force
James H. Havey Jr	Captain	US Air Force
James F. Humphries Jr	Captain	US Air Force
Donald E. Madonna	Captain	US Air Force
Kenneth J. Mason	Captain	US Air Force
Gary W. Mau	Lieutenant	US Navy
Roy E. Palmer Jr	Captain	US Air Force
James J. Rhodes	Captain	US Air Force
Claude H. Segrest Jr	Captain	US Air Force
Frederick Sooe	Civilian	German Air Force
Larry G. Van Pelt	Captain	US Air Force
David H. Williams Jr	Captain	US Air Force

Class 65-A was graduated 13 January and General James A. Doolittle was the guest speaker at the ceremonies. Thirteen Air Force and Navy officers completed the course, as shown below:

Capt	Shirley A. Babin	Capt	Frederick R. Dent III
Capt	Jerry D. Bowline	Capt	Fred H. Ernst
Capt	Laurence C. Curtis Jr	Capt	James K. Olson
Capt	Nathaniel O. Devoll	Capt	George E. Thompson
Capt	John W. Hines	Lt	Nicholas Temple (USN)
Capt	Donald L. Thurman	Lt	Robert L. Crippen (USN)
Capt	Francis Beline		

Captain Bowline received the A. B. Honts Award. This award was established in 1956 by the USAF Experimental Flight Test Pilot School, forerunner of the USAF Aerospace Research Pilot School, commemorating the achievements of Captain Honts, a 1954 graduate of the school. Captain Honts was killed in an aircraft accident 8 February 1955.

Doctor Robert R. Gilruth of NASA, Houston, Texas, was the guest speaker at the graduation exercises for Class 65-B 12 May. The class was comprised of 10 Air Force and two Navy officers named below:

Capt	Karol J. Bobko	Capt	Charles J. Ferrari
Maj	Alan L. Devereaux	Capt	Glen M. Personius
Capt	Robert C. Hover	Capt	Tracy A. Scanlan
Capt	James J. Reed Jr	Capt	Roger J. Smith
Capt	Frank M. Smith	Comdr	Edgar J. Mitchell
Capt	Thomas G. Derrickson III	Lt	Thomas K. Mattingly (USN)

The A. B. Honts Award went to Lieutenant Mattingly (USN).

Two other students were graduated from the Experimental Test Pilot phase of the training course 25 March, they were: Captain Vittorio Meneghine of the Italian Air Force, and Mr Werner Bold of Germany.[11]

Flying Hours and Aircraft:

For the period of January through June a total of 4,802:05 hours were utilized by students and instructors of ARPS. The monthly totals are shown below:[12]

January	859:10	April	799:05
February	798:55	May	769:20
March	773:00	June	802:35

There was no indication that the school's aircraft inventory changed during the period of this report. A complete listing of aircraft will be found in the AFFTC historical report for July-December 1965, page 137.

Following the loss of an F-106A, serial number 57-2238, in December 1965, a replacement aircraft was required; however, one was not received during this reporting period. It was the school's preference to secure an F-106B to serve as the replacement Variable Stability Trainer.

The interim Variable Stability Trainer aircraft, a NF-101A, serial number 53-2422, was reported to have only 80 hours left due to structural fatigue time limitations. Efforts were made to obtain a 300-hour time extension until the F-106B Variable Stability Trainer could be received; an estimated 24 months. This extension was granted following an inspection and repair of the NF-101A at the Sacramento Air Materiel Area.

During May, an F-101 B or F model aircraft was requested to fill the need for a dual control F-101. It was believed the B or F model would provide for a safe flying program on the NF-101A, and allow better utilization of the single seat NF-101A.[13]

A request for a Class V modification of three T-38 aircraft for Variable Dynamic Trainers was submitted to Hq AFSC and, after approval, was forwarded to Hq USAF. The estimated cost for this program was $750,000. In January, the program was on the list of tentative approval pending funding.

The request for funds to modify the three T-38 aircraft was approved by Hq USAF late in April. A planning meeting was scheduled at the San Antonio Air Materiel Area, also negotiations with Cornell Laboratory for preparation of system description and technical backing for request for proposals (RFP) were in progress during late June.[14]