CHRONOLOGY OF F4H-1

I. Program Review Conferences

First Held at M.A.C. St. Louis, 28-29 February 1956
Second Held at M.A.C. St. Louis, 6-7 August 1956
Third Held at M.A.C. St. Louis, 27-28 November 1956
Fourth Held at M.A.C. St. Louis, 20-21 May 1957
Fifth Held at M.A.C. St. Louis, 7-8 August 1957
Sixth Held at M.A.C. St. Louis, 19-20 November 1957
Seventh Held at M.A.C. St. Louis, 18-19 February 1958
Eighth Held at M.A.C. St. Louis, 3-4 June 1958
Ninth Held at M.A.C. St. Louis, 21-22 October 1958
Tenth Held at M.A.C. St. Louis, 17-18 March 1959

II. Maintenance and Engineering Inspection (MEI)

Conducted at M.A.C. St. Louis on 3,4,5 and 6 March 1959

III. Mock-Ups

Cockpit Mock-up Held at M.A.C. St. Louis, 17-18 November 1955
Airplane Mock-up Held at M.A.C. St. Louis, 21-23 November 1955
Lighting Mock-up Held at M.A.C. St. Louis, 2-3 August 1956
Engine Mock-up Held at M.A.C. St. Louis, 10-11 October 1956
Special Weapons Mock-up Held at M.A.C. St. Louis, 3 December 1957
Armament Loading Demonstration Held at M.A.C. St. Louis, 15 May 1958
Cockpit Mock-up Held at M.A.C. St. Louis, 24-25 November 1958
Martin-Baker Seat Evaluation Held at M.A.C. St. Louis, 18-19 February 1959

IV. First Flight

27 May 1958 at Lambert Field, St. Louis

V. Contract Awards

NOas 55-272-c executed 6 August 1957
NOas 57-186 L/I executed 20 December 1956
NOas 59-0245-f executed 25 February 1959

VI. Detail Specifications

SD-513-1 signed 25 July 1955 (Contract NOas 55-272-c)
SD-513-1-1 signed 2 August 1957 (L/I Contract NOas 57-186)
SD-513-1-2 signed 13 March 1958 (Contract NOas 59-0245-f)

COST HISTORY
MODEL F4H-1
CONTRACT 57-186-1

2 May 1956

Received BuAer Confidential letter Aer-CT-34 Serial 06958 dated 24 April 1956 requesting proposal for additional F4H-1 Aircraft for Fiscal Year 1957 procurement (EN 11-305-57)

5 July 1956

Submitted incentive fixed price and delivery proposal for 16, 18, 20 aircraft in accordance with EN 11-305.

16 airplane price was	$40,547,532
18 airplane price was	$44,762,094
20 airplane price was	$48,920,200

24 July 1956

Received BuAer Confidential letter Aer-CT-34 Serial 012247 dated 13 July 1956 requesting resubmittal of EN 11-305-57 based on a quantity of 11 aircraft.

11 airplane price was	$29,138,672

19 Dec. 1956

Received fully executed copy of Letter of Intent for CPFF Contract 57-186 with the following Item and CPFF limitation breakdown:

Item	Price
11 F4H Aircraft including design data drawing, Bill of Material Specifications and Engineering Design Data and Long Lead Time Parts for NAMT (2 sets) limitation	$29,116,343
Spare Parts limitation	$ 5,773,269
Special Support Equip. limitation	$ 1,154,653
Airframe parts limitation	$ 100,000

20 Aug. 1957

Received BuAer Confidential letter Aer-CT-34 Serial 012824 dated 14 Aug. 1957 requesting submittal of EN 11-114-58 based on a quantity of 5, 11, 16 aircraft plus related services and supplies.

22 Oct. 1957

Received BuAer letter Aer-MA-6411/54 dated 15 Oct. 1957 which added APPD to items of work to be performed to Letter of Intent.

23 Oct. 1957

Submitted cost plus fixed fee proposal for 5, 11, 16 aircraft in accordance with EN 11-114-58.

5 airplanes CPFF	$14,174,892
11 airplanes CPFF	$27,429,072
16 airplanes CPFF	$38,115,160
2 NAMT	$ 2,943,778
APPD	$ 143,749

12 Feb. 1958

Received fully executed copy of Amendment 1 to CPFF Contract 57-186-L/I with the following Item and CPFF limitation breakdown:

Item	Price
5 F4H Aircraft including design data drawing and Bill of Material limitation increase	$15,956,377
Training Parts for formal schools limitation increase	$ 100,000
Contractor Spare Parts Support Limitation increase	$ 1,323,000
Supply System Spare Parts Support limitation increase	$ 2,616,000
Special Support Equipment limitation increase	$ 502,150
Airframe parts for Weapon System limitation increase	$ 60,000
NAMT limitation increase	$ 903,926

15 Aug. 1958

Received Amendment 3 to CPFF Contract 57-186-L/I which was a spares provisional billing amendment.

Limitation	$3,516,714

27 Aug. 1958

Submitted incentive fixed price and delivery proposal for 16 aircraft for purpose of definitizing the current letter of intent.

16 F4H-1 airplanes, design data drawing and Bill of Material	$55,147,241
Subcontract Return	$ 647,084

9 Sept. 1958

Received Amendment 6 to CPFF Contract 57-186-L/I increasing progress payment limitation from $15,000,000 to $21,000,000.

20 Nov. 1958

Received Amendment 8 to CPFF Contract 57-186-L/I increasing progress payment limitation from $21,000,000 to $34,000,000.

Received Amendment 9 to CPFF Contract 57-186-L/I which was a spares provisional billing amendment limitation for $406,392.

2 Dec. 1958

Received Amendment 10 to CPFF Contract 57-186-L/I which was a spares provisional amendment decreasing limitation ($10,646)

5 Dec. 1958

Received Amendment 11 to CPFF Contract 57-186-L/I which was spares provisional billing amendment increasing limitation $697,871.

3 Feb. 1959

Received Amendment 12 to CPFF Contract 57-186-L/I which was a spares provisional billing amendment limitation $7,602.

7 Feb. 1959

Received Amendment 13 to CPFF Contract 57-186-L/I which was a spares provisional billing amendment increasing limitation $20,858.

16 March 1959

Received Amendment 14 to CPFF Contract 57-186-L/I which was a spares provisional billing amendment decreasing limitation ($438,275.)

26 March 1959

Received Amendment 15 to CPFF Contract 57-186-L/I increasing progress payment limitation from $34,000,000 to $39,000,000.

21 May 1959

Received definitized incentive fixed price contract 57-186-i

Item	Desription	Limitation	Total Price
1,2,&3	11 F4H-1 Aircraft plus design data test and drawing and bill of material		$35,805,000
4	Publications - Negotiated Separately		
5	Contractor Spare Parts Support		$ 4,200,516
6	Contractor SSE Support	$ 1,154,653	
8	Weapon System Trainer Parts	$ 100,000	
9 & 10	5 F4H Aircraft plus design data test and drawing and bill of material		$16,275,000
12	APPD		$ 145,764
13	Training Parts for School	$ 100,000	
16	370 & 600 gal. External Fuel Tanks	$ 602,332	
17	Contractor Spare Parts Support	$ 1,323,000	
18	Supply Spare Parts Support	$ 2,646,000	
19	Contractor SSE Support	$ 502,150	
20	Supply Parts for Weapon System Trainer	$ 60,000	
21	One NAMT and Design Data	$ 2,253,323	
7,11,14,15	Left Blank		
	Total	$ 8,746,458	$56,426,280
	Grand Total		$65,167,738

2 June 1959

Received Amendment 1 to IFP Contract 57-186-i increasing Item 6, Special Support Equipment from $1,154,653 to $2,154,653.

30 June 1959

DD 1097 indicated an anticipated ceiling as follows:

Description	Price
Basic Airplanes	$57,331,656
Support Equipment including tanks and NAMT	12,242,707
Pending and anticipated ECP's	7,625,964
Total Anticipated Price	$77,200,327

13 August 1959

Request for increase in billing price submitted by M.A.C. Letter 687-14-9811 for $5,251,656. This amount takes into consideration the Contractor's loss in accordance with the incentive provisions of the contract.

Basic Airplanes	MAC Report 4776-6	MAC Report 4776-15
Engineering Cost	$ 4,433,544	$ 5,249,193
Tooling Cost	1,790,470	2,115,745
Production Cost	19,343,233	18,898,260
Procurement Cost	25,213,693	27,679,739
Total Cost	$50,780,940	$53,942,937

30 Sept. 1959

DD 1097 indicated anticipated ceiling as follows:

Description	Price
Basic Airplanes	$57,331,656
Support Equipment including tanks and NAMT	15,514,728
Approved & Pending ECP's	11,332,530
Total Anticipated Ceiling	$84,178,587

4 November 1959

Received Amendment 4 to IFP Contract 57-186-i increasing billing price by $5,251,656 to a total price of $57,331,656.

19 November 1957

Cost History of the F4H-1 Program
Under Contract NOas 55-272-c

The Letter of Intent for Contract NOas 55-272-c was issued on 18 October 1954. This Letter of Intent provided for the construction of two (2) AH-1 airplanes possessing the following general capabilities:

1. All weather general purpose airplane
2. Fixed gun installation
3. Mach 1.5 aircraft utilizing two (2) J65 engines
4. Single place airplane
5. Experimental tooling to be utilized

Subsequently, five (5) additional airplanes were ordered under this Letter of Intent and the estimated cost for this seven (7) airplane program was $58,025,125.

In the period from October 1954 to July 1955, the detail specification was developed. Recognizing that state of the art advances permitted the transition from the AH-1 configuration originally envisioned to a significantly more advanced model, BuAer and the Contractor jointly evolved the configuration now known as the F4H-1 and the detail specification issued on 27 July 1955 reflected this configuration. While the airplane was still of the all weather general purpose type, Vmax was raised to Mach 2.0, the armament installation was changed to all missile and the airplane was changed to a two place configuration. At the same time many other changes were introduced into the detail specification to expand its capabilities. These changes are summarized in Exhibit "A" hereto, however, the following are representative examples:

1. Catapulting under zero wind, military power condition
2. Increased use of titanium
3. Revised strength criteria
4. Steerable dual nose wheels (Provisions)

5. Provision for temporary use of J79-GE-3 engine with CFE equipment requirements that are different from the J79-GE-2 that will ultimately be used.

6. External tanks and provisions for buddy refueling added

Also, it became desirable to change many system, instrumentation and equipment requirements to Contractor furnished because of the development work involved. The items changed to CFE and new CFE requirements resulting from the revised specification are listed in Exhibits "A" and "B". At the same time it was considered necessary to switch to production tooling in accordance with the FIRM Plan concept.

The specification changes added more than 3,000 pounds to the airplane weight empty and more than 5,000 pounds to the take-off gross weight. In addition, the two place version, the missile armament system and the increased performance capabilities add substantially to structure and equipment complexity. It can also be readily appreciated that the flight test program for a Mach 2.0 airplane will involve more expense than that for a Mach 1.5 airplane because it will require more flights to fully explore the expanded flight envelope.

Based on the above factors, the Contractor submitted a cost proposal for an estimated cost of $109,787,561 which was reduced to $107,915,934 by elimination of the barrier-barricade article and to $103,000,000 by subsequent negotiation. It should be recognized that this estimated cost included provisions for Contractor development and procurement of equipment originally planned as Government furnished; therefore, approximately $10,000,000 of this estimated cost represents a reallocation of funds and responsibilities from the Government to the Contractor and <u>not</u> an increase in total program cost.

During the program review of 7-8 August 1957, the Contractor advised that a re-evaluation of this program indicated a probable final cost of approximately

$115,000,000 for the work covered by the negotiated figure mentioned above. In addition, approximately $2,000,000 were anticipated for ECP changes. The increase in estimated cost to $117,000,000 reflects the continuing evolution of the F4H-1 design and includes, in addition to ECP changes amounting to approximately $2,000,000, Contractor initiated changes which are in many instances borderline ECP cases which the Contractor has absorbed. Many of these changes result from continued wind tunnel and functional testing directly related to the F4H-1, while others represent F3H-2 and F-101 flight test developments. Typical of such changes are the following:

1. Extension of leading edge flap to cover entire inner panel span
2. BLC added inner and outer panel L.E. flap
3. Stabilator dihedral revised
4. Revised missile launch system
5. Stabilator structural redesign for flutter loads
6. Revised lateral control system
7. Speed brake system redesign
8. Extended engine air ducts
9. Outer panel snag and dihedral added
10. Outboard center of pressure shift

The above list is a typical cross section of the changes that have been considered and incorporated. Recognizing that the advancement of the aeronautical art permits the continuing evolution of design changes, many of which will be desirable for incorporation in the F4H-1 at the earliest possible time, BuAer and the Contractor are continuing to study areas of future improvement. While such changes may further influence the cost of this development program, the end result will be a more economical and more satisfactory fleet aircraft.

EXHIBIT "A"

Major Changes in Detail Specification Requirements
Between AH-1 and FlH-1 Airplanes

The following constitute a breakdown of changes in the detail specification requirements between MAC Report 3238 dated 13 September 1953 on which the AH-1 price was based and specification SD-513-1 dated 25 July 1955 for the FlH-1 airplane.

	Subject	Change
1.	Carrier Operation	Catapulting required under zero wind, military power conditions. (was 10-knots wind, maximum power) Arresting required under 15-knot wind and 1.3Vs conditions. (was 25-knot wind, and 1.2V_S)
2.	Airplane Performance	Airplane performance considerably increased in quality and quantity. For example Vmax at 35,000: was 1.53M now 2.00M
3.	Airplane Weight	Airplane weight increased a sizeable amount. For example: a. Basic TOGW increased 5141 lbs. b. Weight Empty increased 3031 lbs.
4.	Titanium	Use of titanium increased from 100 lbs to 600 lbs.
5.	Fire Isolation	Method completely revised for installation of J79 engine. Material changes required for conformance with BuAer requirements.
6.	"Ground" Clearance	Clearance between airplane and deck increased to give maximum clearance for catapult shuttle.
7.	Stability and Control	New stability and control specification required. Conformance with the new stability and control specification revised. Several requirements necessitated airplane changes, such as: a. Rolling performance - 20° bank angle in one second. b. Control system power - two engine flameout. c. Speed brake effectiveness
8.	Strength Criteria	New strength specification required. Conference with the new strength and rigidity specification revised. Numerous requirements necessitated airplane changes, such as: a. Negative margin of safety design philosophy practically eliminated.

Subject	Change
8. Strength Criteria (Continued)	b. Fatigue design and analysis required. c. Definition of limit speed. Consideration for strength above limit speed. d. Definition of symmetrical flight V-n diagram. e. Symmetrical pull-out plus gust required for special weapon delivery. f. Rolling pull-out requirements increased. g. Definition of design gross weights. h. External store strength provisions. i. Definition of maximum level flight speed. j. Study of effect of special weapon delivery on structural integrity of airframe required.
9. Tail Group	Thickness ratio of horizontal and vertical tail changed and method of construction revised.
10. Cockpit and Canopy	Tandem cockpit added for two-man operation. Canopy changed to two hinged sections. Canopy operation in 15-foot water depth required. Substantiation for canopy material required.
11. Wheel Brakes	Type of wheel brake system changed and emergency brakes added.
12. Nose Wheel	Changed from single to dual type nose wheel. Steering provisions added.
13. Automatic Pilot	Autopilot changed from GFE to CFE.
14. Engines	Complete revision of basic engine installation to provide for J79-GE-3 temporary and J79-GE-2 final. Associated changes include: a. AC generators and drives must be suitable for the minimum performance specified by BuAer for the final engine. Different equipment will be required for the temporary engine. Drives changed from GFE to CFE. b. Starting system completely revised for final engine. Different equipment will be required for the temporary engine. c. Filtering of engine bleed air for cockpit pressurization may be required.

Subject	Change
14. Engines (Continued)	d. Total pressure variation at the compressor inlet face specified.
	e. Air flow and cooling requirements completely revised.
	f. Engine oil tank, cooler, filters, and supply lines changed from GFE to CFE for temporary engines.
15. Fuel System	Fuel system changes include the following:
	a. External fuel tanks added. Two different size tanks required and will be contractor furnished.
	b. Fuel gaging system revised to eliminate vacumm tubes and to provide for double indication.
	c. Buddy refueling tank added and will be contractor furnished.
	d. Fuel jettisoning for internal wing tanks required.
	e. JP-5 fuel for basic operation specified. Alternate fuels added.
	f. 200-mesh strainer added.
16. Instruments	Following instruments added or changed to contractor furnished:
	a. Wheel and flap position indicator (standard type). (was GFE).
	b. Thrust indicators. (added)
	c. Angle-of-attack system. (was GFE)
	d. Radio indicators. (was GFE)
	e. Statistical accelerometer. (added)
	f. Central air data computer. (added)
	g. True airspeed indicator (added)
	h. Low level fuel warning system. (added)
17. Hydraulic System	Three independent hydraulic systems required.

Subject	Change
18. Electrical System	Electrical System changes included the following: a. Minimum of 75% excess capacity required for AC and DC power. b. Power for specific operations with single engine windmill characteristics must be available. c. Electrical wiring diagrams suitable for maintenance handbook required. d. Wiring mock-up added.
19. Electronics	Electronic changes include the following: a. CNI package expanded to provide equivalent operation for: AN/ARC-52 (was ARC-27A) AN/ARA-25 (was GFE) AN/APX-6B or -20 (was APX-20 only) AN/APA-89 (was GFE) AN/ARR-40 (added) Intercommunication (added) Navigational Computer (added) b. CFE Counter-Electronic Counter - Measure system added c. Space provision for tail warning device added. d. UHF dual antenna system added as CFE.
20. Armament	Armament changes include the following: a. Fixed gun installation deleted and missile installation added. b. Passive defense provisions required. c. Target towing provision required. d. Fire Control System furnished by Government modified for CW injection, missile auxiliaries, and IR detection. e. Cooling air requirements for FCS increased. f. Class D special weapon added. g. Bombing system changed and made a part of basic airplane.

Subject	Change
21. Furnishings	Furnishing changes include the following: a. Ejection seat revised to provide for integrated harness, thin parachute and new seat pan. b. Pressure suit provisions added. c. Windshield rain removal system added. d. Canopy defrosting and defogging required. e. Catapult accessories* to be designed and developed by the contractor. f. Arresting hook to be power-retracted with a contractor furnished hook point. g. Oxygen equipment changed from GFE to CFE and requirement for liquid type added. h. Cockpit steps added. i. Relief tube added.
22. Paint	Exterior paint added.

* Catapulting accessories include the bridle, bridle arrester, holdback and release assembly, and breaking element. The F4H-1 contract requires the development and manufacture of two instrumented bridles, and eight uninstrumented bridles, four bridle arresters, two holdback and release assemblies and two hundred breaking elements.

EXHIBIT "B"

LIST OF ITEMS CHANGED FROM GFE TO CFE

Auto Pilot

AC Generator Drives

Engine Oil Tank

Engine Oil Cooler

Engine Oil Filter

Engine Oil Supply Lines

Wheel and Flap Position Indicator

Angle-of-Attack Indicating System

Radio Indicators

AN/ARA-25

AN/APA-89

CECM Equipment

Oxygen Equipment

COST HISTORY
MODEL F4H-1
Contract NOas 55-272

18 October 1954

A Letter of Intent was executed to provide for the construction of two (2) AH-1 airplanes possessing the following general capabilities:

1. All Weather general purpose airplane
2. Fixed gun installation
3. Mach 1.5 aircraft utilizing two (2) J65 engines
4. Single place airplane
5. Experimental tooling to be utilized

The cost of this program was fixed at $38,061,342.

27 July 1955

In the period from October 54 to July 55, the detail specification was developed and the designation of the aircraft was changed to F4H-1.

31 August 1955

Five (5) additional airplanes were proposed to the Letter of Intent. The estimated cost for this seven (7) airplane program was $58,025,125.

7 March 1956

Amendment two (2) to the Letter of Intent was executed adding five (5) F4H-1 airplanes. The cost of this program being $22,555,000 raising the total value to $60,616,342. Also provisioned was $5,236,414 for spares and support equipment and $55,000 for airframe operational flight training parts.

31 January 1957

Amendment four (4) to the Letter of Intent was executed adding training equipment in the amount of $30,000 raising the total figure to $60,646,342.

5 July 1957

The configuration change from AH-1 to F4H-1 entailed numerous significant changes. While the airplane was still of the all weather general purpose type, Vmax was raised to Mach 2.0, the armament installation changed from fixed guns to all missiles and the airplane was changed to a two place configuration. Many other changes expanded the detail specification, major among these were:

1. Catapulting under zero wind, military power condition.
2. Increased use of titanium.
3. Revised strength criteria.
4. Steerable dual nose wheels (Provisions).
5. Provision for temporary use of J79-GE-3 engine with CFE equipment requirements that are different from the J79-GE-2 that will ultimately be used.
6. External tanks and provisions for buddy refueling added.
7. Production in lieu of Experimental type tooling.
8. Increased structure and Systems equipment complexity.
9. More extensive flight test program.

Based on the above, the contractor proposed a cost figure, including fee, of $117,472,690 which was reduced approximately $2,000,000 by elimination of the barrier-barricade article and to $109,179,950 by subsequent negotiation.

23 July 1957

Amendment ten (10) to the Letter of Intent was executed to increase the dollar limitation by $48,533,608 to cover the cost of the configuration change from AH-1 to F4H-1. This raised the total cost to $103,000,000, plus fee of $6,179,950 for a total of $109,179,950.

7 and 8 August 1957

During the program review conference it was estimated that costs would increase $12,000,000 to TOTAL $115,000,000. When spare parts and fee were considered the total program cost then appeared to be $126,716,363. The $12,000,000 increase, defined below, represents a 7.6 million dollar overrun on the part of the major subcontractor (Northrup) and 4.4 million dollar overrun on the part of MAC.

OVERRUN DEFINITION

Item	Bid	Overrun
Engineering labor, O/H	$ 29,116,462	$ 3,039,000
Tooling labor, O/H	11,520,048	1,198,000
Production labor O/H	22,523,179	—
Procurement	39,840,000	7,763,000
	$103,000,000	$12,000,000

Not included herein, is an estimated $2,000,000 requirement for changes.

12 August 1957

The Letter of Intent was converted to a definitive contract in the amount of $109,179,950 not including spares, special tools, GHE, and OFT airframe parts.

A breakdown of the cost elements is as follows:

Seven F4H-1 Aircraft	$102,994,600	
Airframe parts for OFT	5,400	
Fixed Fee	6,179,950	
TOTAL		$109,179,950

LIMITATIONS

Spare Parts	$4,756,105	
Special Tools	480,299	
Training Parts	200,000	
OFT Training Parts	100,000	
	$5,536,404	$114,716,354

19 - 20 November 1957

Since the August review, no change in total costs for the first seven (7) aircraft was expected. ($115,000,000 cost and $6,179,950 fee - total $121,179,950). Although the estimate of cost remained the same, the method of arriving at same changed.

COST COMPARISON

	August 1957	November 1957
Engineering:	$ 28,833,462 283,000 3,039,000 $ 32,155,462	$ 28,612,000 283,000 $ 28,895,000
Tooling:	$ 11,520,048 1,198,000 $ 12,718,048	$ 13,253,000
Production:	$ 22,523,179	$ 16,261,000
Procurement:	$ 39,840,311 7,763,000 $ 47,603,311	$ 58,592,000
Totals:	$115,000,000 2,001,000 $117,001,000	*$117,001,000 *Includes $2,001,000 unapproved ECPs.

Comparing the projected total cost curve presented in August to the actual total cost curve presented in November, the actuals are approximately $2 million higher through September 1957 than the figure projected to the same date in August 1957.

Another interesting cost factor disclosed at this time which should command future observation is the flight test demonstration program. Significantly, the contractors estimated cost for flight test dropped $5.3 millions from $18.9 to $13.6. It is considered noteworthy that this demonstration requires exploration of areas heretofore unencountered.

February 1958

The contract limitation amount remains at $109,179,950 including fee. When spares, special tools, GHE, and OFT airframe parts are considered the current cost limitation is $114,716,364.

Obviously, a $14,000,000 increase in allowable cost will be needed to cover cost not included when the Letter of Intent was converted to a definitive document in August 1957.

SIGNIFICANT DATES IN THE F4H-1 PROGRAM

1.	BuAer Selected Proposal for A/C with two J-79 engines	- June 1954
2.	First Production Contract for two AH-1	- October 1954
3.	BuAer, CNO agreed to redesignate AH-1 to F4H-1	- December 1954
4.	AH-1 redesignated F4H-1	- June 1955
5.	Production contract for 5 follow-on F4H-1 executed	- March 1956
6.	Production contract for 11 follow-on F4H-1 executed	- December 1956
7.	Production contract for 5 follow-on F4H-1	- February 1958
8.	First flight scheduled	- April 1958
9.	Preliminary RIS conference scheduled	- November 1959
10.	FIP scheduled	- Jan-Feb 1960
11.	Fleet release	- May 1960

F4H - Milestones

1. Unsolicited proposal submitted by MAC to BUAER called the F3H-G/H (General Purpose VF) — 19 Sep 1953

2. Original proposal showed several areas of possible difficulties, lack of a Mil. Req. Similar a/c in program F8U-F5D - no decision was made to procure this a/c with a J65. — Nov 1953

3. Need for an all weather arises (no written requirement) BUAER evaluated
   - F3H-G/H
   - F3H-E2 (single engine version)
   - Grumman Proposal
   - North Amer. Proposal

   Selected MAC a/c with 2- J79 — 15 Jun 1954

4. Procurement initiated on AH-1 (2 a/c) PD-EN11-1542455 serial 017713. This was the F3H-G/H design — 3 Sep 1954

5. Proposed spec too vague - Contractor asked to re-submit - Letter of Intent issued vice contract. — Sep 1954

6. BUAER submitted letter to CNO pointing out design criteria and military capability being used in writing detail specification
   BUAER (AC 261) conf ltr ser 020613 of 22 Oct 1954 — 22 Oct 1954

7. CNO replies to BUAER ltr above and indicates a development characteristic being prepared. Also recommended a two set version CNO conf ltr ser 044P551 of 8 Nov 1954 — 8 Nov 1954

8. BUAER - CNO conference agreed on following:
   (a) Eliminate two seat requirement
   (b) CNO to write a requirement for a two seat attack aircraft
   (c) BUAER - CNO jointly to take necessary action to redesignate AH to F4H
   (d) Following receipt of a CNO requirement BUAER to initiate a design competition for an all weather attack aircraft — 7 Dec 1954

9. CNO conf ltr, serial 0506P551 of 14 Dec 1954 withdrew requirement for a two seat all weather fighter — 14 Dec 1954

10. CNO conf ltr serial 038P551 of 14 Mar 1955 requested a program review of the AH to determine:
   (a) Proceed with development as now visualized, or
   (b) Cease further development — 14 Mar 1954

11. Above conference held and decided to continue with program - expected initial fleet delivery to be mid 1959 — 31 Mar 1955

12. BUAER conf ltr of 15 Apr 1955 (AC 26) pointed out to CNO latest configuration and performance estimates of the AH-1. The J65 was replaced by the J79 — 15 Apr 1955

13. Detailed specification signed by contractor - not yet signed by BUAER — 27 May 1955

14. CNO conf ltr serial 091P551 of 26 May 1955 specified features desired in AH-1 and recommended redesignation to the F4H. This letter contained certain changes required for the F4H, primarily armament. BUAER did not sign detail specification and notified contractor of changes required — 31 May 1956

15. CNO conf ltr serial 0101P551 of 7 June 1955. Indicates a requirement for a two seat version of the F4H-1 (AH) — 7 Jun 1955

16. AH-1 redesignated F4H-1 — 23 Jun 1955

17. CNO conf ltr serial 0118P551 of 19 July 1955 defined configuration of F4H-1 — 19 Jul 1955

18. Detail specification signed by both parties — 25 Jul 1955

19. Fire Control System changed to AMCS - Aero - XlA, a simpler, missile only Fire Control system — 26 Aug 1955

20. BUAER PD-ER11-2:2-56 serial 015879 of 2 Sep 1955, procurement of (5) F4H — 2 Sep 1955

21. Cockpit Mock Up - MAC — 16-18 Nov 1955

22. Aircraft Mock Up - MAC — 21-23 Nov 1955

23. OPNAV Notice - serial 0204OP50 of 6 Feb 1956 issued - statement of Planned Introduction — 6 Feb 1956

24. BUAER - MAC Engineering and Production Review conference. Revealed delay in the release of engineering drawings by the contractor; program may slip from 2 to 4 months unless overtime is allowed — 28-29 Feb 1956

25. MAC conf ltr 38-14-2380 of 1 May 1956 and BAR endorsement - 1 serial 0114L4 of 4 May 1956 - Reveals delay in program and request overtime. BUAER conf ltr serial 06973 of 22 May grants overtime in some areas, notes October first flight date cannot be met and indicates action to amend contract delivery dates to

1958

J	M	A	M	J	J	A	S	O
1	0	1	0	1	1	1	1	1

MAC believes he can make December 1957 as first flight date — 22 May 1956

26. CNO conf ltr serial 0467551 of 23 May 1956 modified the configuration of the F4H-1:

(a) Deleted requirement for Mk-7 special weapon
(b) Back-up weapon system of Sparrow II is reaffirmed
(c) Simultaneous carriage of Sidewinder and Sparrow II 23 May 1956

August 1956 - Wind tunnel tests encouraging. MAC confident F4H will perform as guaranteed.

.1st flight now scheduled for Feb. 1958; however, MAC believes overtime will make Dec. 57 1st flight possible.

September 1956 - MAC has study underway to determine desirability of 1st flight at St. Louis, or Edwards. Decision made to have 1st flight at Edwards.

September 1956 - Stretch-out of 11 ea. aircraft on FY 57 program results in slipping fleet release to 1st quarter of Calendar 1960.

October 1956 - Two (2) months slippage of AFA-128 (due to lack of design approval). This equipment is scheduled for 5th and subsequent aircraft.

November 1956 - Fleet release now scheduled for July or August 1960. In addition, 1st flight at Edwards will delay 1st flight until March 1958.

Letter of Intent executed for 11 (FY 57) aircraft.

April 1957 - The configuration change from AH-1 to F4H-1 entailed numerous significant changes. While the airplane was still of the all weather general purpose type, Vmax was raised to Mach 2.0, the armament installation changed from fixed guns to all missiles, and the airplane was changed to a two-place configuration. Many other changes expanded the detail specification; major among these were:

1. Catapulting under zero wind, military power condition.
2. Increased use of titanium.
3. Revised strength criteria.
4. Steerable dual nose wheels (Provisions).
5. Provision for temporary use of J79-GE-2 engine with CVE equipment requirements that are different from the J79-GE-2 that will ultimately be used.
6. External tanks and provisions for buddy refueling added.
7. Production in lieu of Experimental type tooling.
8. Increased structure and systems equipment complexity.
9. More extensive flight test program.

September 1957 - BuAer confirmed a 13% cruise drag improvement due to inflight tests of ejector nozzles (similar to J79-2)

MAC was directed to make 1st flight at St. Louis. This will result in 1st flight in April 1958.

November 1957 - NOTS informed BuAer that folding fin Sidewinder would result in 20% reduction in reliability. Consequently, alternate armament program, required by CNO, is now to provide 4 external Sidewinders with 2 additional Sparrow III's in lieu of Sidewinders.

TIME HISTORY OF McDONNELL AIRPLANES

RF-101A - AF33(

F3H-2N-2P-NOa(s)
(AIRPLANES 150 -

F-101A AF55(600)-6743

LTR. INTENT
3 JAN. 52

F3H-1N-2N-NOa(s)-51-640
(AIRPLANES 1-150)

1ST FLT. 16 MAR. 51
LTR. INTENT 22 MAR. 51

F2H-3-NOa(s)-51-023

LTR. INTENT
14 JUL. 49

1ST FLT. 2

F2H-2-NOa(s)-10481

LTR. INTENT
26 SEP. 48

1-1ST FLT. -2
3 JAN. 49

2-1ST FLT. -2P
24 FEB. 51

LAST
DEL.

XF3H-1-NOa(s)-10260

LTR. INTENT
3 JAN. 49

1-1ST FLT. 7 AUG. 51
2-1ST FLT. 12 JAN. 52

F2H-2-NOa(s)-9768

LTR. INTENT
11 MAY 48

1ST FLT.-2
18 AUG. 49

1ST FLT.-2N
3 FEB. 50

1ST FLT. 2P
12 OCT. 50

NO. 319 DEL (FINAL A/C)
29 DEC. 50

F2H-1-NOa(s)-9022

CONTRACT
29 MAY 47

1ST FLT.
10 AUG. 48

FLY AWAY NO. 54 (FINAL A/C)
4 AUG. 49

AF33(038)-7442 (TURBOPROP)

AF33(600)-15163

XF-88-W33-038-ac-14582

LTR. OF INTENT AND
START DES. 7 MAY 46

CONTRACT
14 FEB. 47

NO. 1 1ST FLT. NO. 2
20 OCT. 48 24 APR. 49

1ST AIR FLT.
9 JUN. 49

PHASE 2 DEMS. WITH
AIR-1M JUN. 50

1ST PLACE PENETRATION
MISSION COMPL. 14 JUL. 52

PHASE 2 DEMS. COMPL. 26 MAR. 52

XF-85-W33-038-ac-13996

LETTER OF INTENT AND
START DES. 9 OCT. 45

CONTRACT
24 DEC. 46

1ST FLIGHT
23 AUG. 48

CONTRACT TERMINATION
27 OCT. 49

FH-1-NOa(s)-6242

CONTRACT-7 MAR. 45

1ST FLT-28 OCT. 46

FINAL DEMS.
(PATUXENT) AUG 47

1ST CARRIER
OPERATIONS
APRIL 48

FLY AWAY NO. 60
(FINAL A/C)
29 MAY 48

CONTRACT TERMINATION
30 JUN. 49

XF2H-1-NOa(s)-6130

START DESIGN
1 JAN. 1946

1

CONTRACT
2 MAR. 46

2

FIRST FLIGHTS - NO. 1 11 JAN. 47
NO. 2 9 MAR. 47
NO. 3 17 SEP. 47

NO. 1 FLY AWAY
MAR. 49

NO. 2
NOV. 49

CONTRACT TERMINATION
OCT. 50

XFD-1-NOa(s)-161

START OF DESIGN
1 JAN. 1943

CONTRACT
30 AUG. 43

NO. 1 1ST FLT-26 JAN '45
NO. 2 1ST FLT. - 25 JUN. '45

CONTRACT TERMINATION
26 AUG. 1947

XP-67-W535-ac-21218

CONTRACT-26 SEPT. 1941

1ST FLT. 6 JAN '44

CONTRACT TERMINATION
26 OCT. 1944

110
100
90
80
70
60
50
40
30
20
10
0

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951

15 - F101
20 F4H

F-101 - AF53(600) - 29841
LTR. INTENT 3 MAR. '55
TARGET 1ST FLT. 1. YF-101 30 NOV. '56 2. PROD. 30 JUN. '57

AH-1 - NOa(s)55 - 272
LTR. INTENT 18 OCT. 1954
F4H
TARGET 1ST FLT 30 MAR. '57 SEPT.

RF-101A - AF53(600)-25399
LTR. INTENT 29 JAN. '53
TARGET 1ST FLT. 1. F-101A 30 SEP. '55 2. RF-101 30 NOV. '55

F3H-2N-2P-NOa(s)-53204
2 INTERPLANES 15°0 — 4)
LTR. INTENT 24 SEP. '52
TARGET 1ST FLT. -2N 30 SEP. '55
TARGET 1ST FLT. -2N 30 MAR. '56

F-101A AF53(600)-6743
LTR. INTENT 5 JAN. '52
1ST FLT. 29 SEP. '54
TARGET 1ST FLT. YRF-101 30 APR. '55

-1N-2N-NOa(s)-51-640
RPLANES 1-15°0)
1ST FLT. 26 MAR. '51
LTR. INTENT 22 MAR. '51
1ST FLT. -2 DEC. '53 F3H-1
1ST FLT 30 OCT. '54 YF3H-1N
1ST FLT 11 JAN. '55 F3H-2N PROTO.

NOa(s)-51-023
LTR. INTENT 14 JUL. '50
1ST FLT 29 MAR. '52
LAST F2H-2P DEL. 28 MAY '52
1. LAST -3 DEL 24 SEP. '53
2. LAST -4 DEL 31 OCT. '53

. INTENT SEP. '49
1-1ST FLT. - 5 JAN. '51
2-1ST FLT. -2P 24 FEB. '51
LAST F2H-2, -2P DEL. 30 APR. '52
LAST JOB ORDER 1ST JAN. '55

1-1ST FLT. 7 AUG. '51 - SEP. 8 TO PRATT
2-1ST FLT. 12 JAN. '52 - JAN 20 TO PRATT
NO 1 CRASHED 9 MAR. '54
NO. 2 DEL. 2 DEC. '54
TARGET TERMINATION 30 JUN. '55

-2 1ST FLT -2N 3 FEB. '50
1ST FLT -2P 12 OCT. '50
NO. 19 DEL (FINAL A/C) 29 DEC. '50
LAST JOB ORDER 31 OCT. '54

NO. 56 (FINAL A/C.) '49
LAST JOB ORDER 30 JUN. '53
(65B)-7442 (TURBOPROP)
AF53(600)-5163
1ST A/B FLT. 9 JUN. '49
PHASE 2 DEMS WITH A/B 14 JUN. '50
PHASE 2 DEMS. COMPL. 24 MAR. '52
1ST PLACE PENETRATION FIGHTER COMP. IN JUL. '50
NO. 1 DEL. 10 JUL. '53
NO. 2 DEL 2 MAR. '55

CT TERMINATION OCT. '49

CT TERMINATION N. '49

WAY NO. 2 NOV. '49
CONTRACT TERMINATION OCT. '50

MARCH 1955

110 100 90 80 70 60 50 40 30 20 10 0

'49 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960