

# *National Air and Space Intelligence Center*

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## **HAVE DRILL/HAVE FERRY TACTICAL EVALUATION**

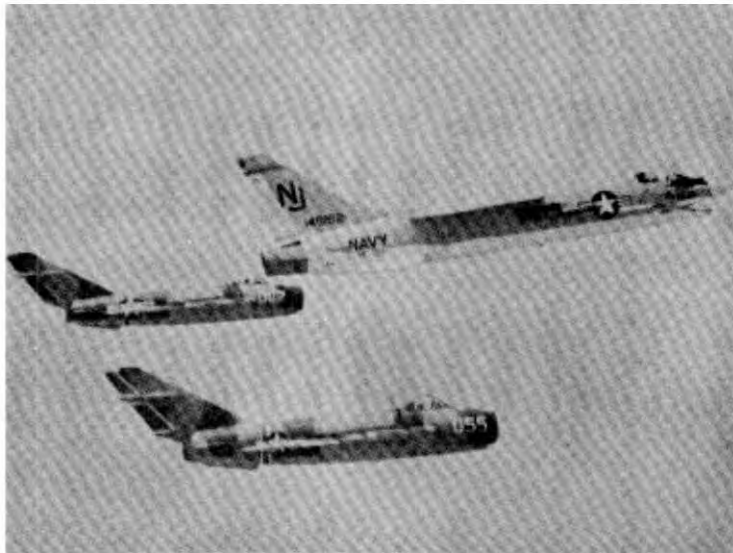


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Air Combat Effectiveness and Technology

**This Briefing  
is Classified:**

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**HAVE DRILL/  
HAVE FERRY  
TACTICAL EVALUATION**



## *Purpose*

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- **Determine the effectiveness of existing tactics employed by US airplanes and associated weapons systems against the MiG-17**
- **Exploit the tactical capabilities and limitations of the MiG-17 in the air-to-air environment when employed singly and in section against US tactical airplanes**
- **Optimize existing tactics and develop new tactical techniques as necessary to defeat the MiG-17**
- **Evaluate the design, performance, and handling qualities of the MiG-17**
- **Expose USAF and USN tactical aircrews to simulated combat with an aggressively flown MiG-17.**





## ***Weapon System Highlights***

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- **1 x 37mm cannon with 40 rounds**
- **2 x 27mm cannon with 80 rounds each**
- **Approximately 6 seconds of continuous firing time**
- **Optical gyroscopic lead computing optical sight**
  - **Range only radar**
- **Sirena radar warning receiver (tail aspect only)**
- **SRO-2 Identification Friend or Foe Transponder**

**No airborne intercept radar or missiles  
Not very sophisticated for 1969!**



## ***Key Statements – Air Force***

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- **“The great majority of tactical engagements against the MiG-17F in SEA have been in the low altitude regime where the FRESCO C low wing loading and 8 g structural limit are best optimized and utilized. It is the outstanding maneuverability the airplane possesses in this area that permits this rather old and simple fighter airplane to remain such a potent threat in this day of sophisticated modern weaponry.”**



## *Key Statements – USN*

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- **“Every Navy pilot engaged in the project lost his first engagement with the Fresco C. The Fresco’s overall performance in the ACM (Air Combat Maneuvering) environment surprised all crews concerned with the project. The A/B on the Fresco engine gives it a performance level that cannot be duplicated or realistically simulated by U.S. airplanes with similar turn capability. Thus U.S. pilots were not accustomed to fighting an airplane with such an engine/turn performance combination. The relative age of the Fresco also led to a general overconfidence by U.S. crews prior to their first engagement. ”**



## ***Key Statements – USN***

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- **“There are no U.S. Navy airplanes that can simulate the performance of the Fresco C. Consequently, the aircrews who fought the Fresco during the test had no ACM training against this type airplane. The great improvement in U.S. Navy aircrew performance after only on simulated ACM engagement dramatically illustrated the lack of realistic ACM training”**





## ***Key Statements – USAF***

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- **“All project pilots agreed that prior to their first engagement they had seriously underestimated the capabilities of the Fresco C.” – USN**
- **“The performance qualities of the Fresco C are accurately defined in the energy maneuverability charts contained in FTD-CS-09-5-67” – USAF AFFTC**
- **“Substantial information concerning the actual capabilities of the Fresco C was available prior to Project Have Drill. In all significant cases this information was validated by the results of this project.” – USAF FTD**

**The MiG-17 capabilities should have surprised no one!  
OVERCONFIDENCE-COMPLACENCY-POOR TRAINING**

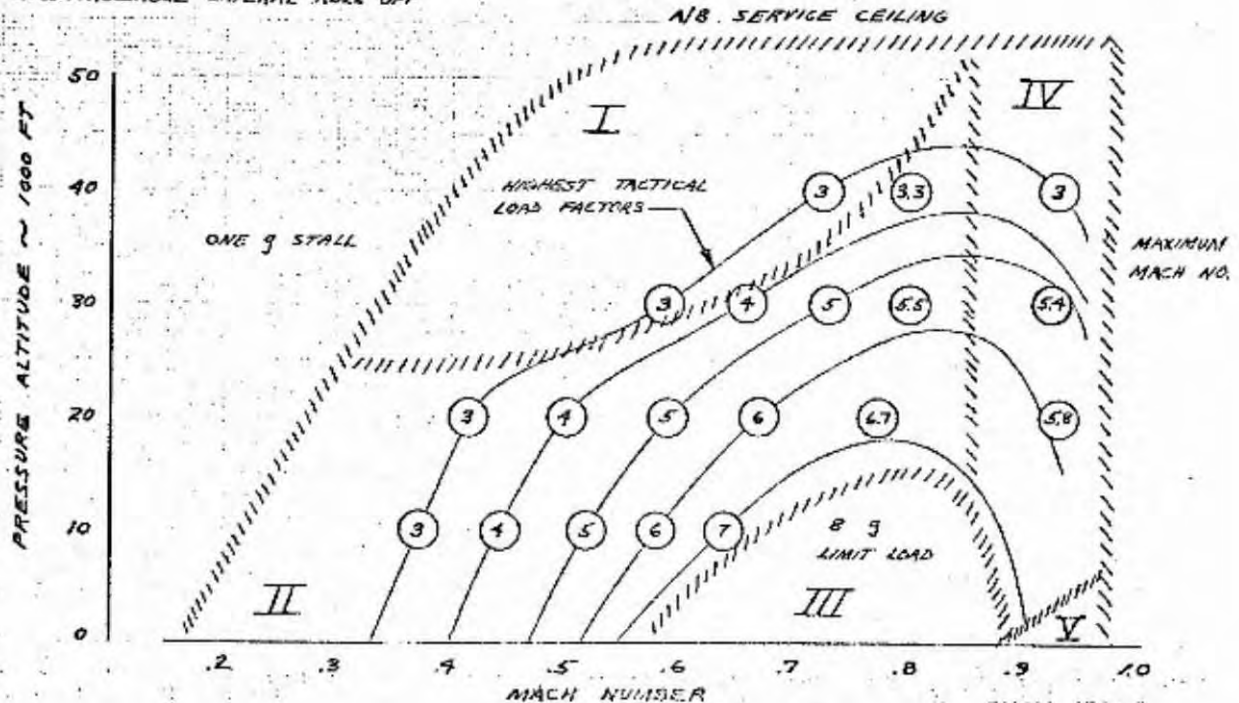




# MiG-17 Maneuverability

## LONGITUDINAL MANEUVERING SUMMARY

- ~~(S/US)~~
- REGION I: TENDENCY TO PITCH-UP, ACCELERATED STALL, AND SPIN
  - REGION II: MANEUVERING CAPABILITY LIMITED BY HEAVY BUFFET OR ACCELERATED STALL
  - REGION III: 8 g STRUCTURAL LIMIT
  - REGION IV: EXCESSIVE STICK FORCES RESTRICT LOAD FACTOR
  - REGION V: UNCONTROLLABLE LATERAL ROLL OFF

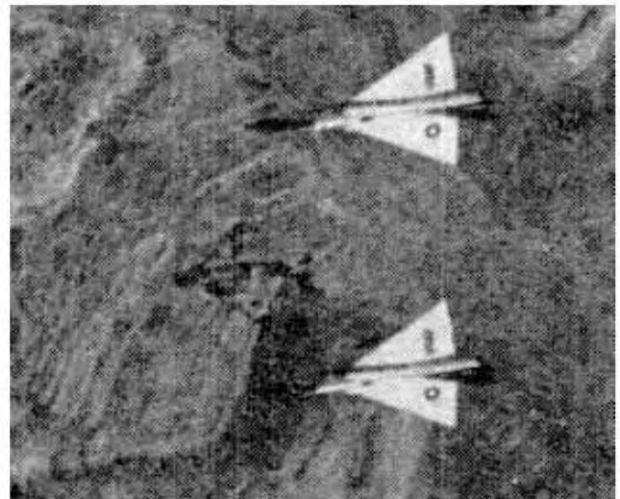
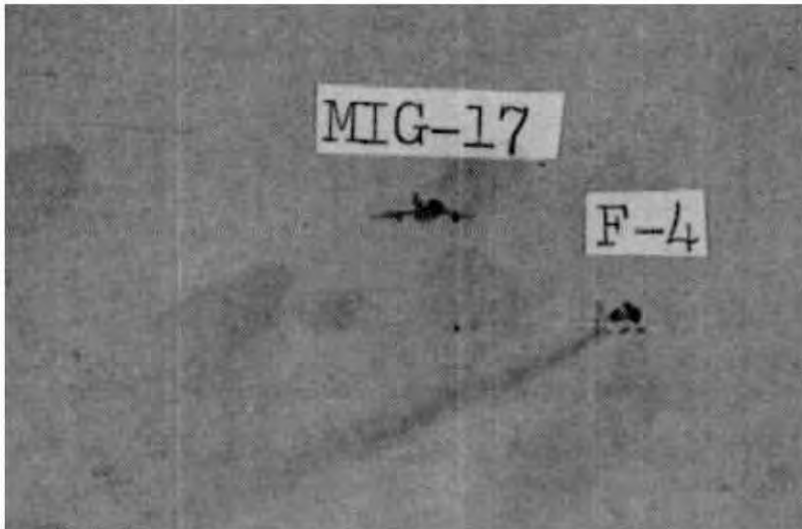




## Key Statements

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- “It was difficult to acquire and retain visual contact with the Fresco C in the ACM environment” – USN
- “Fighter aircrews should be acutely aware of the visual acquisition problem presented by Fresco C size targets prior to, during, and subsequent to an engagement.”





## *TAC Evaluation* Scope

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- 57 Tactical Air Command missions with the MiG-17F







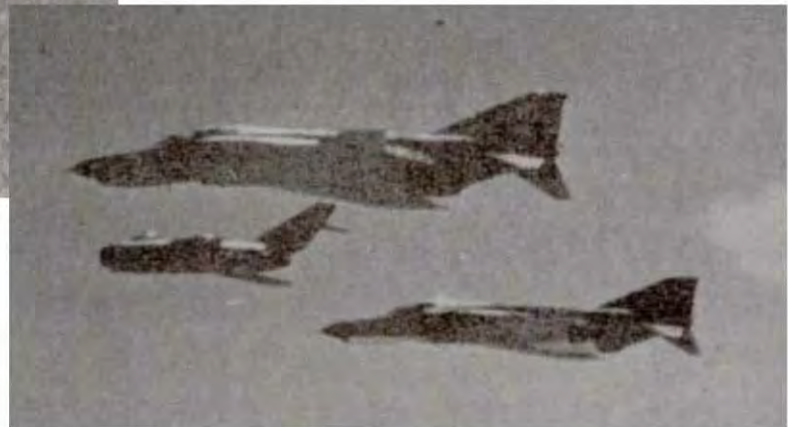
# TAC Evaluation Scope

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- F-4C/D Phantom II
- F-4E Phantom II

**11.33 Missions**

**13.83 Missions**



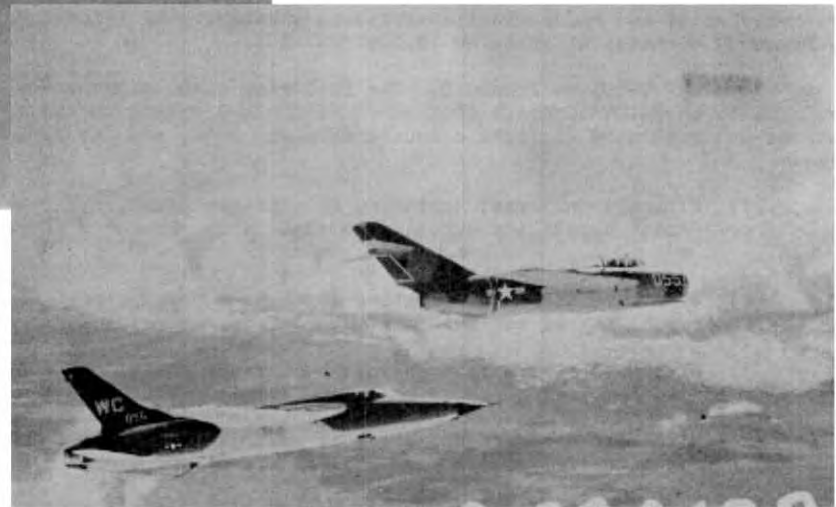


# TAC Evaluation Scope

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■ F-105D/F Thunderchief

11 Missions



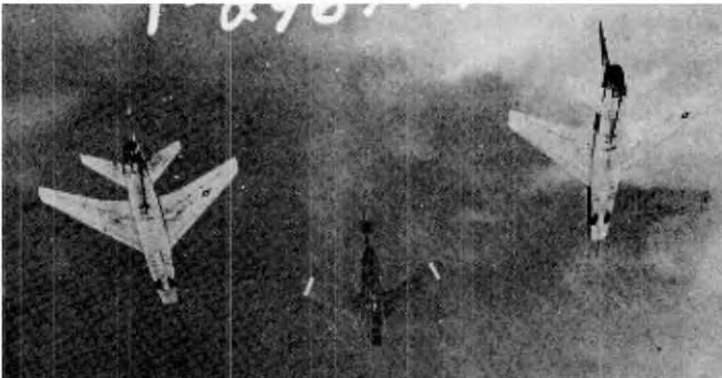
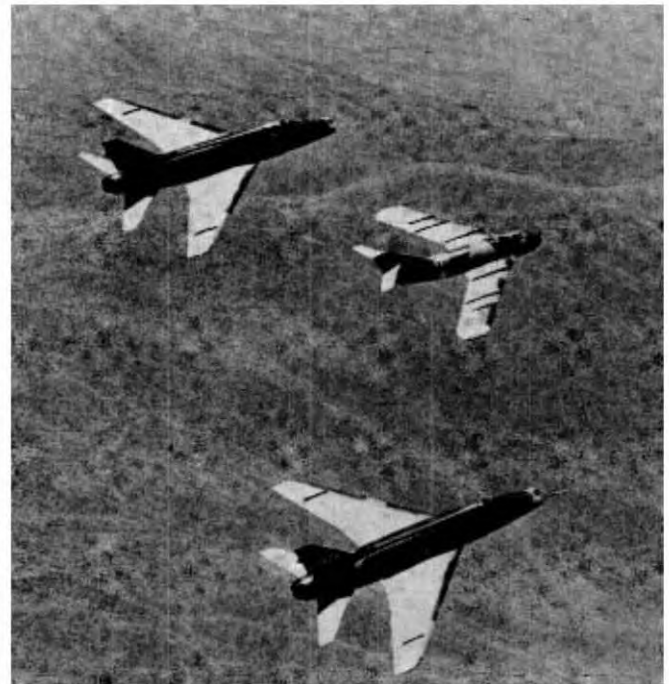
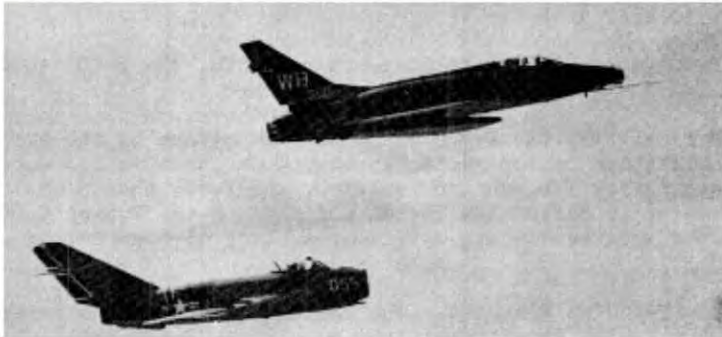


# TAC Evaluation Scope

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■ F-100D Super Sabre

6 Missions





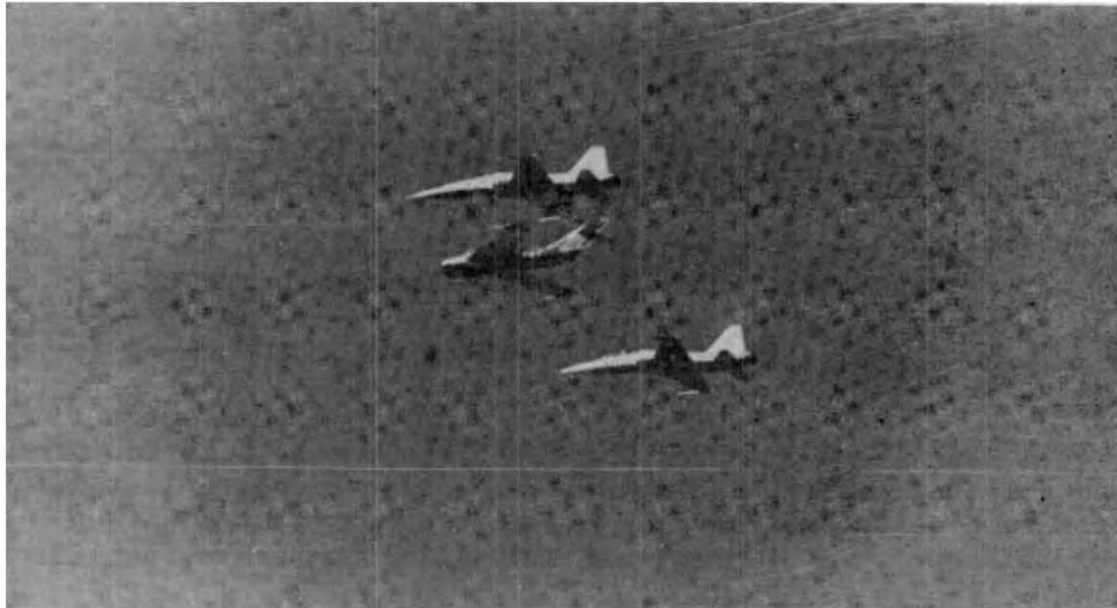


# TAC Evaluation Scope

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■ F-5A Freedom Fighter

2 Missions



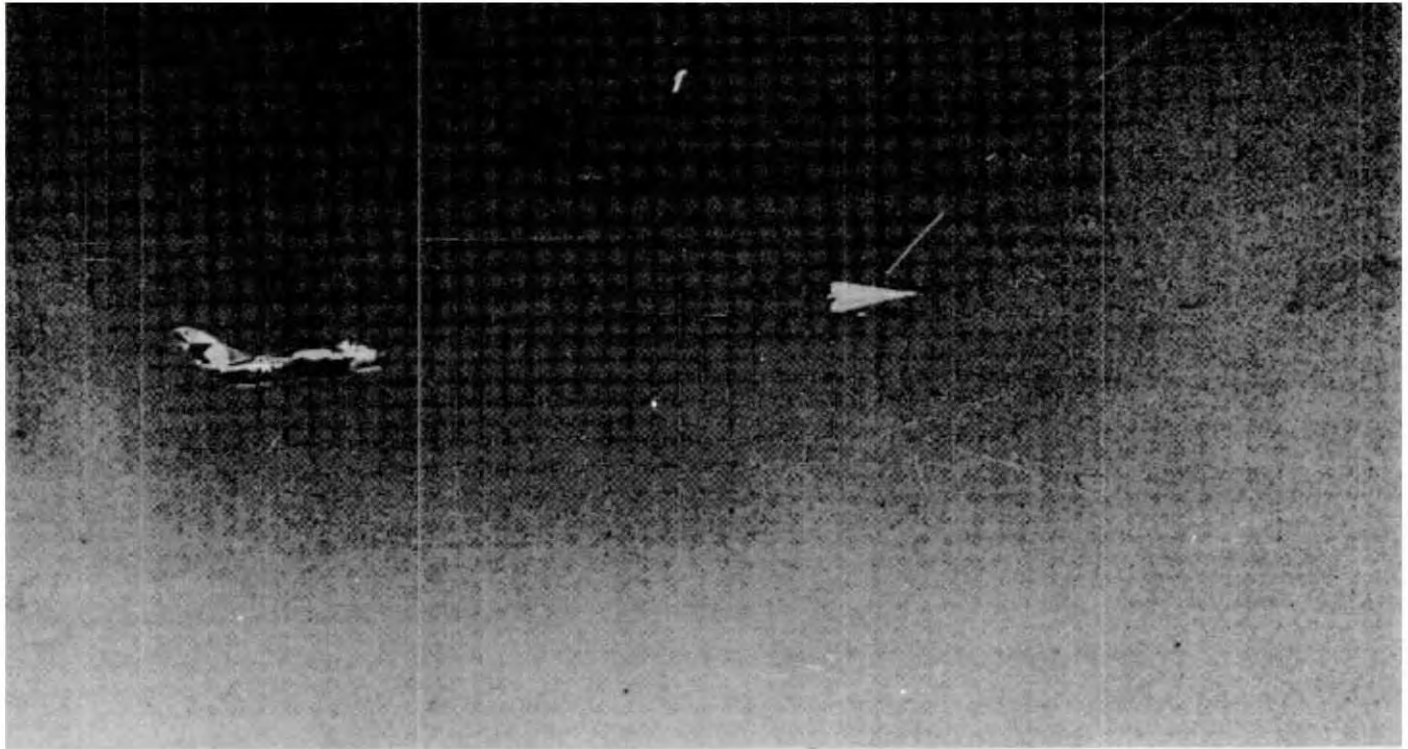


# TAC Evaluation Scope

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■ Air-to-Air Gunnery

5.5 Missions





# TAC Evaluation Scope

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## ■ Air-to-Ground Gunnery

5.33 Missions







# *TAC Evaluation* Scope

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■ Photo/Pilot Checkout

2 Missions



# ***TAC Evaluation***

## **MiG-17F Limitations and Deficiencies**

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- **Above 0.85 Mach or 450 KIAS high control forces result in very slow roll rate and pitch change capability**
- **Dutch Roll tendency above 375 KIAS and difficult yaw control in turbulent air at any speed**
- **Weapon limitations**
  - **Low firing rate (900 rpm 23 mm, 400 rpm 37mm)**
  - **Low muzzle velocity (2250 fps)**
  - **Excessive tracking time for lead computation (2-3 seconds)**
  - **Large lead required due to low muzzle velocity and projectile weights**



# TAC Evaluation Performance Comparison

AREA OF COMPARISON	F-4	F-105	F-100	F-5
<b>ACCELERATION</b>				
Level, MIL	Superior	Superior	Superior	Superior
Level, MAX	Superior	Superior	Superior	Superior
Level, MIL to MAX	Inferior	Inferior	N/A	N/A
Unloaded, MIL	Superior	Superior	Comparable	Slightly Superior
Unloaded, MAX	Superior	Superior	Superior	Superior
Unloaded, MIL to MAX	Inferior	Slightly Inferior	Slightly Inferior	N/A
<b>ZOOM</b>				
MAX to MAX	Superior	Superior	Comparable	Superior
MIL to MIL	Superior	Superior	Comparable	Superior
MIL to MAX	Comparable	Comparable	N/A	N/A





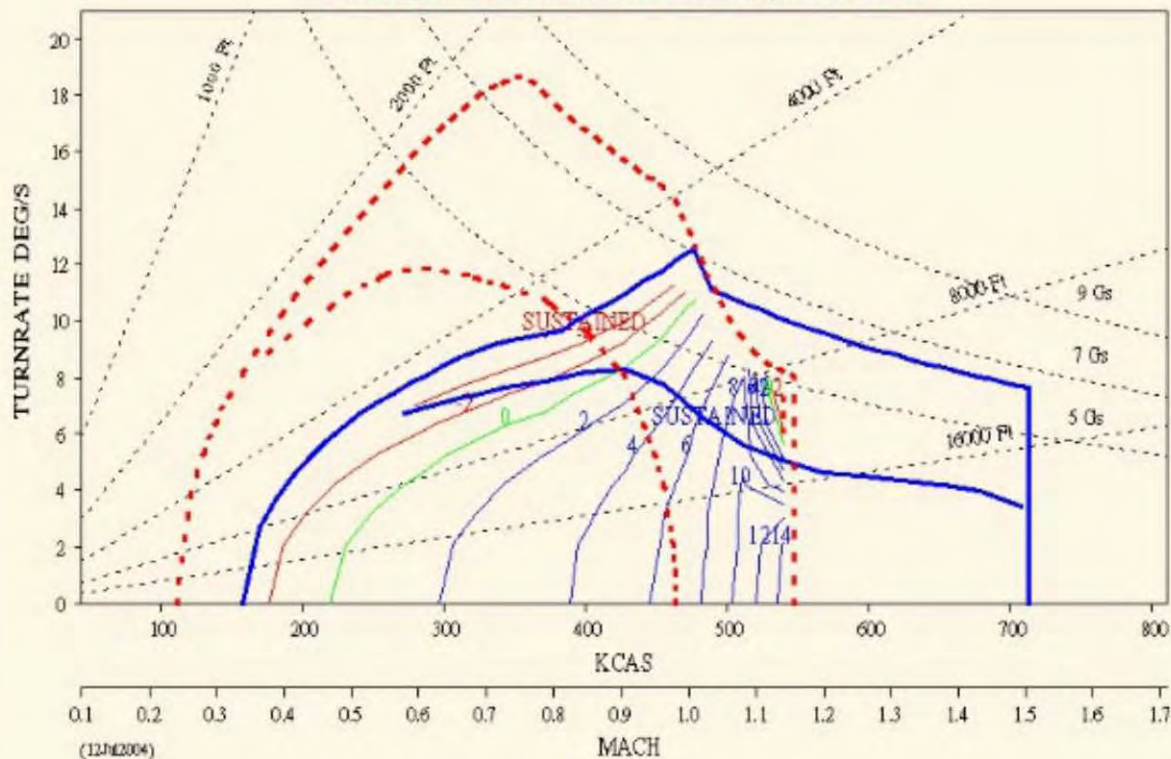
# TAC Evaluation Performance Comparison

AREA OF COMPARISON	F-4	F-105	F-100	F-5
<b>TURN</b>				
0.9 Mach/450 KIAS, MAX	Comparable	Superior	Superior	Superior
0.9 Mach/450 KIAS, MIL	Comparable	Comparable	Comparable	Superior
350 KIAS, MAX	Inferior	Inferior	Inferior	Comparable
350 KIAS, MIL	Inferior	Inferior	Inferior	Comparable
<b>ROLL</b>				
450 KIAS	Superior	Superior	Superior	Far Superior
350 KIAS	Superior	Superior	Superior	Superior
<b>SPEEDBRAKE DECELERATION</b>				
Constant Power	Inferior	Inferior	Inferior	Inferior
Idle Power	Inferior	Inferior	Inferior	Inferior

F-4D vs. FRESCO C  
 Delta Longitudinal Acceleration (KCAS/sec)  
 (Turnrate vs Mach)  
 Maximum Afterburning Power

Contours represent R-4D performance  
 minus FRESCO C performance.  
 Solid boundary is  
 R-4D envelope.  
 Dashed boundary is  
 FRESCO C envelope.

F-4D with no stores and 50% internal fuel; 35950 lb; 20000 ft  
 versus FRESCO C with no stores and 50% internal fuel; 10950 lb; 20000 ft



20,000 Ft Altitude



## TAC Evaluation F-4C/D/E

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- **The effectiveness of the F-4 radar and radar missile system is substantially reduced when the MiG-17 operates at or below 10,000 ft AGL**





## TAC Evaluation

### General Conclusions

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- Tactics against the MiG-17 should emphasize **mutual support** and **split plane** maneuvering
- The **MiG-17 is superior in the high AOA** max performance maneuvering and low speed (250 KIAS or slower) arena
- The **F-4, F-105, F-100, and F-5 all have vertical maneuvering superiority**. This can a decisive advantage for the F-4 and F-5 with a low G pitch to vertical
- **MiG-17 lethal position can be defeated above 450 KIAS** by rapid unloaded reversals and 30-60 deg check turns—maintaining high calibrated airspeed
- **Accelerating at 30-60 deg nose low during escape can force the MiG-17 pilot “into a realm of flight wherein his capability to pull out becomes his dominate consideration”**



## ***TAC Evaluation***

### **General Conclusions (cont.)**

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- **MiG-17 is very difficult to acquire with the unaided eye**
  - F-5 was also difficult, F-4 was by far the easiest
  - Serious misjudgments in range during first encounters
  - MiG-17 had negligible exhaust trail
- **Southeast Asia fighter wing tactical doctrine generally quite accurate for MiG-17 but should be updated to incorporate findings**
- **Tactics in AFM 3-1 are still valid**
- **F-4 and F-105 APR-25/26 radar warning receiver can warn of MiG-17 range only radar presence**
  - AAA/A1 light





# TAC Evaluation

## General Recommendations

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- Flight tactics emphasize **mutual support** between elements and **split plane** maneuvering
- Employ **superior acceleration** and **vertical maneuvering** to control engagements with the MiG-17
- **Elimination of exhaust trails** should be a primary engine design consideration for future US fighters
- Update wing fighter doctrine to include test findings
- Combat crew **training should address aircraft with various performance characteristics**
- Use **steep dive angles to disengage** if conditions permit
- Keep **ingress speed high** to permit rapid acceleration to negate a MiG-17 gun attack from the rear
- Crews must **know how tough it is to see** MiG-17 size aircraft





## ***TAC Evaluation*** **Further Recommendations**

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- **Following initial confrontation and subsequent separation from a MiG-17 in a one-on-one situation**
  - **For F-4 Aircrews: Don't reattack unless you can get sufficient separation (2.5 – 3 miles) while maintaining visual contact**
  - **For F-105, F-5, and F-100 Aircrews: Avoid attempting to reattack unless you enjoy a tactical advantage**

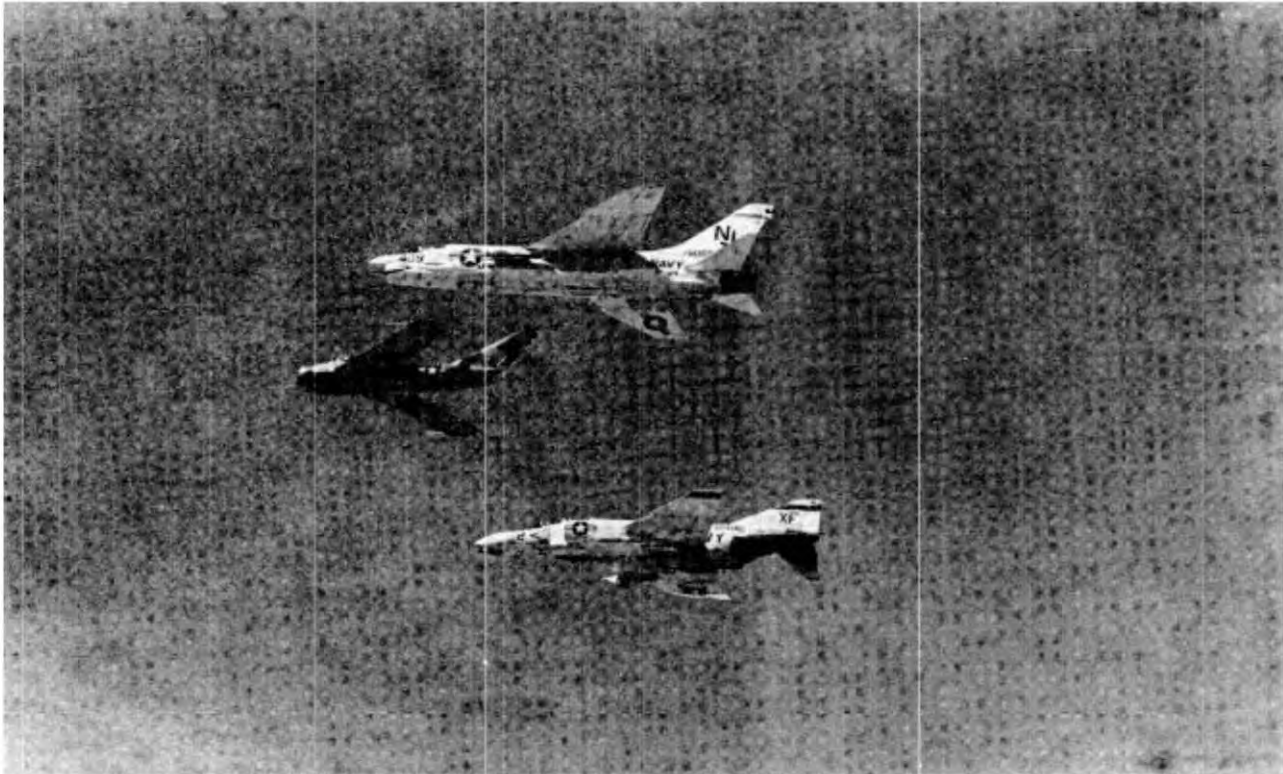
**If you get away, don't go back unless it's on your terms!**



# *USN Evaluation Scope*

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- 47 United States Navy missions with the MiG-17F

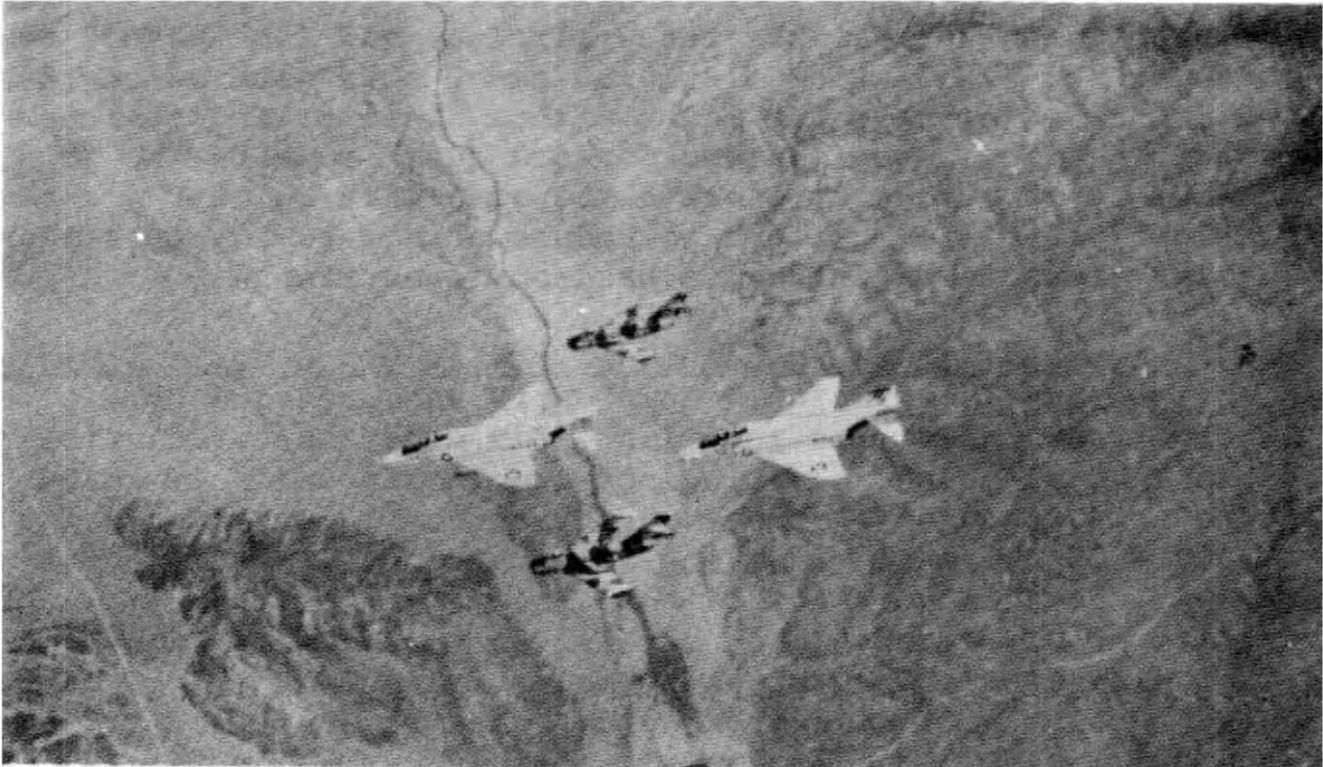




# *USN Evaluation Scope*

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- **F-4B/J Phantom II**      **18.5 Missions**





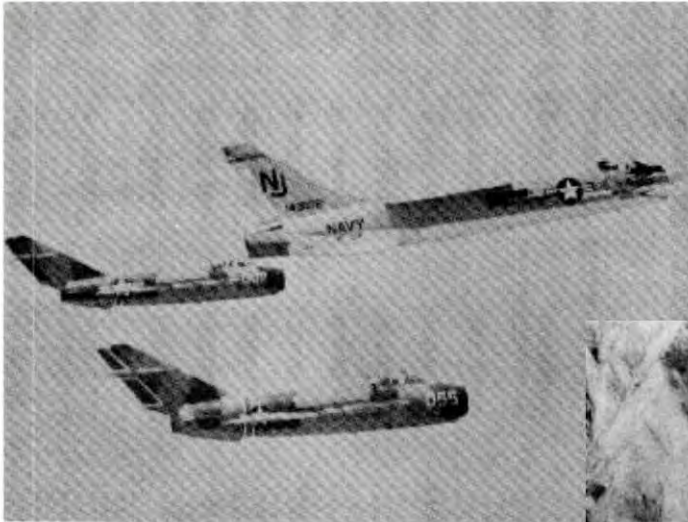


# *USN Evaluation* Scope

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■ F-8H/J Crusader

16.5 Missions





# *USN Evaluation Scope*

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■ **A-4F Skyhawk**

**4 Missions**





# *USN Evaluation Scope*

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■ A-6A Intruder

4 Missions





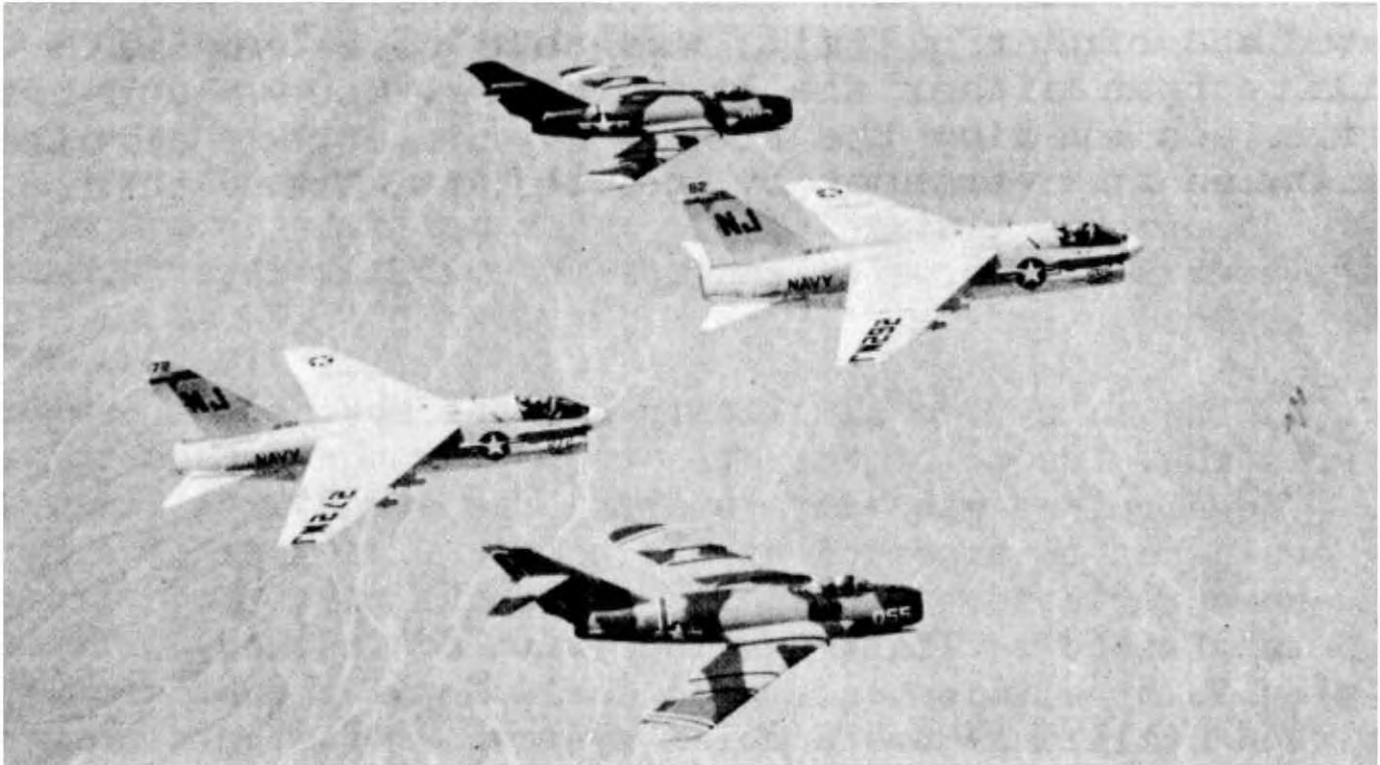


# *USN Evaluation Scope*

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■ A-7A Corsair II

4 Missions





# USN Evaluation Performance Comparison

AREA OF COMPARISON	F-4	F-8	A-4	A-6	A-7
<b>ACCELERATION</b>					
MIL	Sig. Superior	Superior	Superior	Superior	Inferior
MAX	Sig. Superior	Sig. Superior	Inferior	Inferior	Inferior
<b>DYN. PRESSURE LIMIT</b>	Sig. Superior	Sig. Superior	Comparable	Superior	Comparable
<b>DECELERATION</b>					
With Power	Inferior	Inferior	Inferior	Inferior	Superior
Without Power	Comparable	Inferior	Inferior	Inferior	Superior
<b>ROLL RATE</b>	Superior	Superior	Superior	Superior	Superior
<b>TURN RADIUS</b>					
Above 450 KIAS	Superior	Superior	Superior	Superior	Superior
Below 450 KIAS	Inferior	Inferior	Inferior	Inferior	Inferior
<b>TURN RATE</b>					
Above 450 KIAS	Superior	Superior	Superior	Superior	Superior
Below 450 KIAS	Inferior	Inferior	Inferior	Inferior	Inferior
<b>ZOOM</b>					
MIL	Sig. Superior	Superior	Comparable	Comparable	Comparable
MAX	Sig. Superior	Sig. Superior	Inferior	Inferior	Inferior



## ***USN Evaluation*** **Conclusions**

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- **The MiG-17 is capable of defeating any USN tactical airplane in a turning fight at and below 475 KIAS**
- **Camouflage paint and small size make visual acquisition and retention difficult (Must keep visual contact)**
- **Q limit seriously inhibits MiG-17 total effectiveness**
- **Extremely fuel limited**
- **Head on visual ID in the F-4 is not effective**
  - **Hard to acquire MiG-17 on radar**
  - **F-4 visually acquired at longer range by MiG-17 pilot (smoke!)**
- **Two F-4s can remain 100% offensive against two MiG-17s due to overall performance superiority**
- **USN attack airplanes have no offensive capability against the MiG-17**





## ***USN Evaluation Recommendations***

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- **USN fighters should:**
  - **Maintain a high energy level – 500-600 KIAS**
  - **Avoid high G maneuvers below 500 KIAS**
  - **Use thrust advantage to prevent MiG-17 from getting gun position**
  - **Force the MiG-17 to fight above 475 KIAS**
  - **Engage only as a section with strict mutual support**
  - **Use afterburner judiciously to take advantage of low MiG-17 fuel**
  - **Exploit MiG-17 weaknesses: blind area below the horizontal plane, poor roll rate, and marginal control at high q**
  - **Use when necessary max rate/min radius turns 2-3nm from the MiG-17 and reverse based on energy and tactical situation**



## ***USN Evaluation*** **Recommendations**

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- **The A-4, A-6, and A-7 should not engage the MiG-17**
- **If the A-4, A-6, or A-7 are engaged by the MiG-17**
  - **Jettison non air-to-air stores**
  - **Unload, dive, and accelerate**
  - **Utilize maximum roll rate**
  - **Run out at maximum airspeed and minimum altitude**



## *USN Evaluation* Recommendations

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- If reversal or turn is necessary ensure range is at least 2-3 nm from the MiG-17 then max turn to pass head on
- Maintain strict lookout in enemy territory
- Weave and vary headings in a threat area
- Practice realistic air combat maneuvering (ACM) as much as possible against small airplanes with low wing loading
- Whenever possible train over land
- Pilots practice coaching RIOs on targets
- Squadron training of RIOs and BNs be intensified for ACM
- ACM training for attack aircrews be intensified at all levels



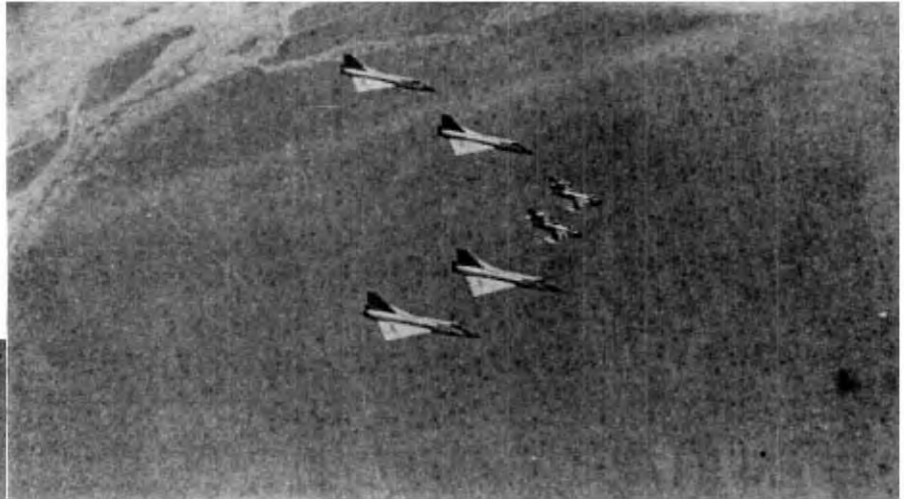


# *ADC Evaluation Scope*

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■ **F-106A Delta Dart**

**13 Missions**



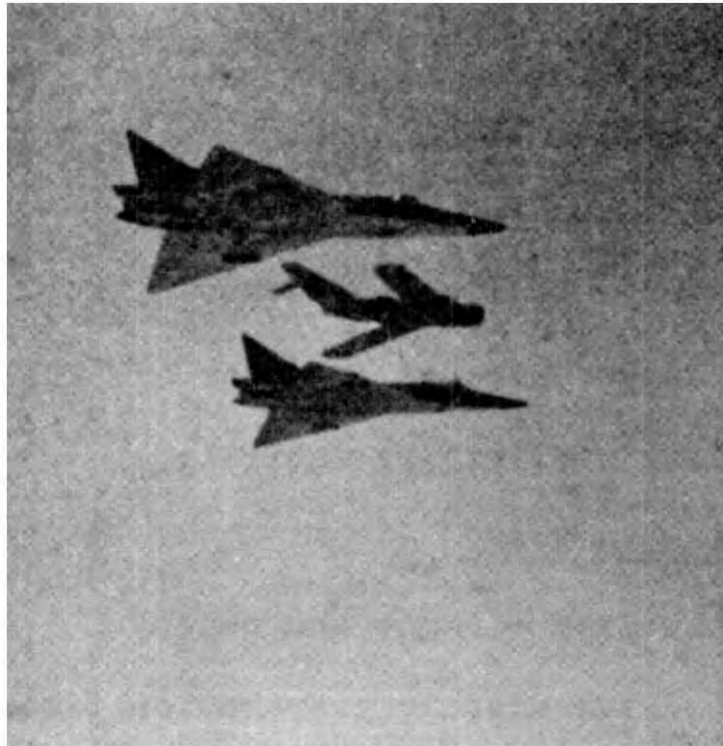


# *ADC Evaluation*

## *Scope*

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- **F-102A Delta Dagger 5 Missions**



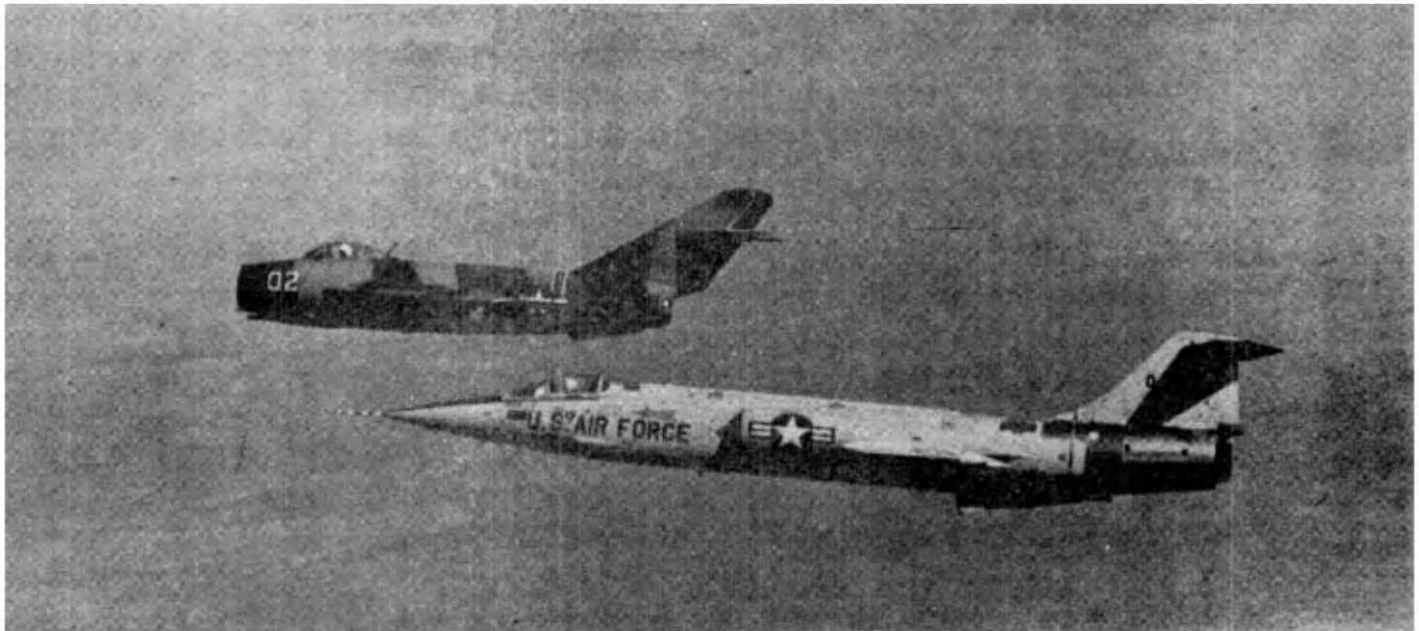


# *ADC Evaluation Scope*

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■ **F-104A Starfighter**

**5 Missions**







## ***ADC Evaluation Recommendations***

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- Expedite fitting the internal gun, redesigned canopy, radar warning, and ECM equipment into the F-106
- Continue tactics development
- Reduce time required to prepare and fire missiles from the F-102
- F-102 units go to four-ship tactics instead of two-ship
- All future US fighter developments include a gun as well as missiles
- Future US fighter developments include extensive maintainability/reliability studies with eye toward simplifying avionics, fire control, and general systems