2.10.3 VIDEO RESOURCES

I found the following three videos very interesting (National Aerospace Library). They are quite old, but better made that many other documentaries or educational material made nowadays.

- Part I: Approaching the Speed of Sound;
- Part II: Transonic Flight;
- Part III: Beyond the Speed of Sound.

2.11 WING SHAPES

Probably aviation enthusiast, at some point, noticed how different aircraft features wing of different size or shape. Some of them are almost non-existent compared to the fuselage (looking at you, F-104!), others are bigger and perhaps able to move back and forth (F-14). Another, perhaps, have a couple of odd-looking "fins" near the cockpit (Eurofighter).
This short Chapter introduce the general advantages and the disadvantages of the wing types and features commonly adopted by fighter aircraft.

2.11.1 BRIEF HISTORY

The following is a very short overview of some common wing configurations through history. It is important to note that experiments, tests and less known shapes have always been used and theory-crafted, but rarely came to fruition due to lack of key factors such as proper understanding of the involved phenomenons or materials.

FROM WWI AND WWII TO THE JET ERA

One of the first common wing shape is the classic rectangle, still in use today for low-speed, permissive aircraft.

This shape fell out of favour as the speed of the aircraft increased due to its limitations. As the speed increases, in fact, the airflow can become supersonic before the aircraft does, creating shock waves and other disrupting effects. This type of wing is unsuitable for transonic and supersonic speeds.
Early tests conducted by the Germans, even before the development of their first jet aircraft, proved that a swept wing could delay the effect mentioned before, on top on reducing drag.

The preferred airfoil design moved from the a thinner, with two or possibly more wings (biplane, triplane) of the WWI to a thicker and thus stronger configuration. This move came with other advantages, as fuel could now be stored in the wings, and the landing gear retracted.

The jet era saw a return to a thinner airfoil design and new wing shapes. The driving force was the necessity of reducing the adverse shock waves over the wing, which cause drag and reduce lift in subsonic aircraft.

As the WWII mantra "the faster, the better" continued through the 50s, the airfoil became even thinner and the wing shapes moved towards delta and swept (with some notable exceptions, such as the F-104 – *are those even wings?*).

VARIABLE SWEEP WING: THE PERFECT SOLUTION?

Straight wings are very efficient in low-speed flight, but lose performance as the speed increase. So, why not making the wing capable of pivoting near its root, thus allowing the aircraft to change its geometry whilst flying?
This idea became quite popular for a time, and a number of aircraft designed in the late 60s adopted the variable sweep solution. Between them, some of the most popular aircraft of the era: the F-14 Tomcat, the F-111 Aardvark, the Tornado, the MiG-23 and the Sukhoi Su-24.
The advantages are quite intuitive: as the name of the game was still "gotta go fast", the variable sweep wing allowed optimal high-speed configuration, along the ability of maintaining good control at low-speed. The former requirement was necessary for Naval aircraft such as the F-14 or the F-111B, along the ability of landing or taking off from short or unpaved runways, a necessity in case of all-out war between Soviets and NATO.

As time passes, new material were discovered or introduced and technology advanced, providing the engineers with tools to overcome the limitations of the previous technological generation. Other reasons for moving forward from the variable geometry design are the complex design, manufacturing process and maintenance of the sweep wings compared to a conventional design. Just take a look at the MiG-23 folding gear mechanism. Beautiful and very ingenious, but incredibly complex.
Another step forward is the change of philosophy: speed is always good, but nowadays being harder to spot is often more important.

INSTABILITY (& STEALTH) IS THE NEW BLACK

Fly-By-Wire is a common word nowadays, but it has been one of the key factor to enable the design and the introduction of intrinsically unstable aircraft (among other applications). Instability can be obtained by designing an aircraft with a centre of gravity towards the end of the aircraft, rather than located in the neutral point. This situation allows the aircraft to react faster to the inputs, affecting the manoeuvrability. However, controlling such aircraft without any assistance may be very hard and fatiguing, if not impossible (see effects such as the Pilot-induces oscillation).

As the focus shifted towards the "stealth" factor, designs, and wing shapes drastically changed again, sometimes departing for the conventional designs. For example, the last of the century series, the F-117 Nighthawk, features a high sweep angle wing but rather unconventional appearance aimed to reduce its radar cross-section to an incredible 0.001 m². For comparison[13], the F-15's radar cross-section is 25 m², the F-16's is 5 m².

2.11.2 WING SHAPE EXAMPLES

Important!
Many wing classifications have a number of subcategories. For example, the Delta Wing configuration can be tail-less, or the wings can be cropped.
The Pros & Cons here described are very broad and "high level", to introduce the general peculiarities of a wing configuration. This is certainly not an engineering treatise!

RECTANGULAR

Plate 2: Fieseler Fi 156 Storch - Source Wikipedia.

- Classic shape, common in small aircraft, easy to manufacture;
- Good stall characteristics, since the stall starts at the wing root, rather than the control surfaces, making it very controllable.
- Inefficient, especially at higher speeds, in terms of weight and drag;
- In military aviation, often surpassed in favour of Elliptical, Tapered or other configurations.

13 Source: Globalsecurity.org – Radar Cross Section (RCS).

SWEPT

Plate 3: Mikoyan-Gurevich MiG-15 - Source Wikipedia.

- Efficient at transonic speed due to reduced drag in this region;
- Critical Mach Number drastically increased;
- Poor slow-speed characteristics and handling more difficult due to the reduced lift generated by the wings.

DELTA

Plate 4: Mikoyan-Gurevich MiG-21 - Source Wikipedia.

- Efficient through different regimes, good instantaneous turn rate compared to others;
- large surface area, reducing wing loading;
- usually relatively thin and thus offering reduced drag;
- depending on the construction, it can hold an appreciable amount of fuel, despite the reduced thickness;
- More drag generated than, for example, swept wings, often requiring a more powerful engine to achieve the same performance of other configurations;
- peculiar low speed characteristic, requiring high angle of attack at take off and landing to generate lift.

VARIABLE

Plate 5: RAF Panavia Tornado GR4 - Source Wikipedia.

- Efficient in any region, due to the capability of adjusting the sweep angle;
- both good slow and high speed characteristics.

- Incremented mechanical complexity, affecting cost and design choices;
- generally heavier construction than other configurations.

The discussion about pros and cons of various wing types is fascinating. A starting point can be this Wikipedia page about the Wing Configuration, but there are numerous details articles all over the internet.

2.12 AZIMUTH TRIANGULATION

There are maps in DCS without any DME compatible with western aircraft (e.g. TACAN), such as parts of the Persian Gulf or the North of the Caucasus.
Most aircraft from the mid-70s onwards have an Inertial Navigation System (INS – see Chapter 2.7) onboard, if not a GPS directly, so navigating is elementary. But what if the INS is damaged, no DMEs are available nearby and the scenario does not offer any recognisable landmark?

The odds of such a scenario happening are almost zero, so this is a rather light-hearted look a how no one will ever use the ADF in DCS.

2.12.1 CROSSING THE STREAMS

Bearings triangulation is a process that allow to determine the position of an object knowing the bearings from the object to two known positions. This is a simple technique very familiar to hikers, especially before the introduction of the GPS.
For example, a hiker can determine his position on a map by means of a compass, by using two clearly recognizable points (such as peaks or other landmarks). Considerations about the Magnetic Declination aside, the process can be recapped in:

- measure the bearing to point A and draw the corresponding line on the map;
- measure the bearing to point B and draw the corresponding line on the map;
- check where the lines intersect. This is your position.

2.12.2 PRACTICAL EXAMPLE

Although the scenario mentioned above is a very, very rare occasion in the F-14 and more modern aircraft, it can be used in dire straits.

In this scenario, our F-14 was dragged near the Iraq-Iranian border. The safety of the carrier is somewhere near the Bahrain (which is missing from the map entirely, but that's another matter). In a furious dogfight, the INS broke down. The crew looks outside, scanning for known landmarks.
No luck today.

Figure 26: Scenario - Scanning for landmarks. Nice view!

Since nothing meaningful is distinguishable, the crew can attempt to fly circa towards the South, taking the risk of running out of fuel.
The map, however, shows the location of a bunch of VOR/DME station that should be somewhat close to the F-14 (Figure 27).

Figure 27: Scenario - VOR/DME in the assumed area.

The brave RIO[14] then tunes his AN/ARC-182 to 115.800 MHz, being it the most Southern, switches the mode to "DF" and checks the Morse code identification.

> --
> .-
> ....

Confirms the "MAH". The BDHI reads:

Figure 28: BDHI for VOR/DME 115.800MHz "MAH"

Using the reciprocal of the reading is easier, in this case is 315° (Figure 28). We can plot the direction on the F-10 map (Figure 29).

14 The Direction Finder function in the pilot's radio (AN/ARC-159) is not implemented. Hence only the RIO can save the day!

Figure 29: First VOR/DME plotted on the map.

Unfortunately DCS does not allow to draw multiple lines and bearings on the F-10 map. Therefore, unless you have a printed copy, the whole process will be quite imprecise.


Figure 30: BDHI for VOR/DME 114.000MHz "AWZ".

The next step is repeating the process with another VOR/DME. 114.00 MHz, "AWZ" looks farily close to the previous direction.

Working again with the reciprocal (280° - Figure 30), we plot the result on the map.

Figure 31: Second VOR/DME plotted on the map.

Unfortunately, DCS does not provide anything more than a ruler in the F-10 map. Moreover, the aircraft is moving whilst the RIO completes these operations. Therefore, the result is all but a precise determination of the position of the aircraft.

Figure 32: Position of the aircraft assessed by using two VOR stations.

On the other hand, once the general location has been established, it is easy to find they way home.

As mentioned before, the odds of following such a procedure in a fairly modern aircraft are incredibly limited but, who knows, it may come handy at some point! Moreover, the whole procedure would be much easier if two radios were able to use the ADF function at the same time, whereas in the F-14, only the RIO can.

2.13 ANECDOTE: THE OVERWHELMING TRIO – AIC, SA, COMMS

Picture me, fresh newbie wannabe Radar Intercept Officer. Contrary to nowadays, in-depth documentation was not readily available. Not to mention how long it takes to study and digest the documentation.

So, here we are, daring to take on the first mission, not even six months after the release of the F-14B.

Tasking: BARCAP, PG map. We cover the north of the Strait of Hormuz, just west of Qeshm island. The mission is PvE/P. Meaning PvE plus humans role-playing and caring about their virtual life and their task (which is the best way to enjoy DCS, imo). After the usual few hours of briefing and discussions through the week preceding the mission, we go up. We check in with the first human controller and proceed as fragged. Second check in, we reach the CAP ACM, and establish our pattern.

We soon get the call, two Outlaws. A few minutes later, the RWR warns us about something coming from the not-really-friendly area. "Evil" F-14s.

I maintain radar awareness. The bad guys are fast, 40,000ft, hot. The controller has not escalated, and the redfor Tomcats are still classified as Outlaws.

At some point, we see something coming towards us on the TID (back then the AIM-54s were picked up by the AWACS and shared via Datalink). We ask for the classification: still Outlaw!

We turn cold and dive as the RWR goes off. It's too late. The mission is already over.

Legends say that the classification of those Hostile is still Outlaw…

NEW LESSONS LEARNT

I admit we were pissed. Big time pissed. Planning a mission takes several hours, and seeing it finished in barely 30' is not ideal. However, it is a video game, and after a few moments we were cool and tried to understand what went wrong.

Comms

I did not own the comms. Since I was new to the platform and to the air-to-air world, plus the fact that many players were in the mission, not being a native speaker, lack of confidence in myself and my ability, and other reasons, I left the comms to my pilot. Huge mistake! He did great, but he did not have the awareness that the avionics in the back seat give you! I asked him to raise the classification with the AIC. I should have done it instead.

> **Lesson**: speak up! Better using plain words and get the job done, rather than delaying or being silent because you are unsure of the appropriate lexicon. Moreover, it's a video-game!

Situational Awareness

I saw the two now-hostile F-14s flying when they were still very far.
I monitored them as they turned from Flanking to Hot and climbed.
I recognized the attack profile, as they were about to launch, but I did not consider them an immediate threat.
I even saw the datalinked AIM-54s coming at us.
Yet I failed to describe the situation to my Pilot and when we turned cold it was too late.

> **Lesson**: learn to build and improve your awareness. The Pilot relies on the RIO in this regard. Feeling overwhelmed is normal, but he cannot take action if you do not command it, or if he does not understand the situation.

Controllers

AIC (Air Intercept Controller) and GCI (Ground-Controlled Interception controller) have to deal with different aircraft, each with their own issues, peculiarities and capabilities (back then, there was no NAVGRID, for example). More importantly, they work with different player, with different knowledge of their aircraft, DCS and aviation in general. They are also humans too (or so they say)!

Lesson: Controllers may also suffer lacking situational awareness, they may be in fewer number than required, thus feeling overwhelmed. Use your awareness to complement the information from the controller. Use contract to dictate the escalation of the classification. Don't be a spectator: help them to help you by working together.

THE RISE OF JUDY

In late 2019, the TV series "*Better Call Saul*" was quite popular. Playing on the wording of the brevity "**Judy**", I decided to close the incident by all having a good laugh on it: since the AIC did not escalate the classification of the enemy fighters, preventing us from actively engaging them, next time we'll call Judy and do it ourselves!

Figure 33: Better Call Judy!

For the curious, this is the definition of the brevity Judy:

> *[A/A] Aircrew has taken control of the intercept and only requires situation awareness information; controller will minimize radio transmissions.*
>
> **ATP 1-02.1/MCRP 3-30B.1/NTTP 6-02.1/AFTTP 3-2.5 – 2020**

2.14 NOTES ON DCS VEHICLE DAMAGE MODEL

Note: The following tests were initially part of the overview of the Mk-20 Rockeye, but I decided to move them to a dedicated Chapter as the tone became more generalised. The discussion about the Mk-20s can be found in Paragraph 13.2.2 .

The damage model of the vehicles and ships in DCS looks very bland prima facie. Non-aerial vehicles show only an "HP" bar on top of their icon in the F10 map, but do not demonstrate anything more complex than that. In fact, even a simple damage model such as the one used in arcade games such as War Thunder (ground) would be a drastic improvement, not to mention something closer to "Gunner Heat PC".

Although some improvements were promised, the damage system has already a very elementary progression system and resistance to penetration and damage. Different weapons deal damage in different ways and this is easily proved: for example, try bombing an armoured ship with non-penetrating weapons versus ordnance more appropriate.

2.14.1 SHIPS

An interesting observation can be made about the ships' damage model. Although it is based on a "Hit points" system, at least some of them, have a few more features. This is easily tested by dropping Mk-20s and verifying how many bomblets are necessary to sink a boat, and which capabilities are lost due to the inflicted damage.

In the example here discussed, I noticed that hitting the stern rather than mid-ship or the bow, results in less damage inflicted.
More tests show the effect against other military ships such as the Moskva Cruiser. Two Mk-20s were dropped in pairs following the heading of the moving Moskva. The Cruiser lost about 30% of its HP following the attack.

Figure 34: Effect of two Mk-20 Rockeyes versus the Moskva Cruiser. Note the bomblets still falling and impacting the ship.

A Corvette such as the Grisha suffers more damages following the same attack procedure, down to 50% HP.

When an unarmoured ship is targeted, such as a tanker, it is immediately destroyed (Figure 35).

Figure 35: Effect of two Mk-20 Rockeyes versus a tanker.

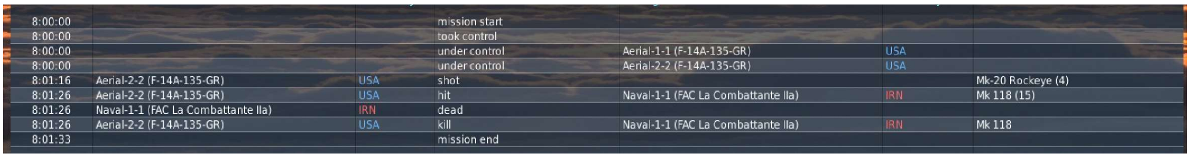
If you want to know how many of them hit a target, check the Mission Debriefing screen. Figure 36 shows the number of bombets that hit a "*La Combattante II*" class frigate using a single Rockeye.

Figure 37 instead shows the number of hits using four Mk-20s, rippled in pairs to hit the moving target. In this case, the ship was sunk.

Figure 38 instead shows another delivery of four Rockeyes with conspicuous impacts, but the ship, albeit down to 20% of its original HP, was still afloat.

8:00:00			mission start			
8:00:00			took control			
8:00:00			under control	Aerial-2-2 (F-14A-135-GR)	USA	
8:01:23	Aerial-2-2 (F-14A-135-GR)	USA	shot			Mk-20 Rockeye
8:01:34	Aerial-2-2 (F-14A-135-GR)	USA	hit	Naval-1-1 (FAC La Combattante IIa)	IRN	Mk 118 (7)
8:01:38			mission end			

Figure 36: DCS mission debriefing page (single Mk-20).



8:00:00			mission start			
8:00:00			took control			
8:00:00			under control	Aerial-1-1 (F-14A-135-GR)	USA	
8:00:00			under control	Aerial-2-2 (F-14A-135-GR)	USA	
8:01:16	Aerial-2-2 (F-14A-135-GR)	USA	shot			Mk-20 Rockeye (4)
8:01:26	Aerial-2-2 (F-14A-135-GR)	USA	hit	Naval-1-1 (FAC La Combattante IIa)	IRN	Mk 118 (15)
8:01:26	Naval-1-1 (FAC La Combattante IIa)	IRN	dead			
8:01:26	Aerial-2-2 (F-14A-135-GR)	USA	kill	Naval-1-1 (FAC La Combattante IIa)	IRN	Mk 118
8:01:33			mission end			

Figure 37: DCS mission debriefing page. Four Mk-20 and ship sunk.

8:00:00			mission start			
8:00:00			took control			
8:00:00			under control	Aerial-2-2 (F-14A-135-GR)	USA	
8:01:13	Aerial-2-2 (F-14A-135-GR)	USA	shot			Mk-20 Rockeye (4)
8:01:23	Aerial-2-2 (F-14A-135-GR)	USA	hit	Naval-1-1 (FAC La Combattante IIa)	IRN	Mk 118 (21)
8:01:34			mission end			

Figure 38: DCS mission debriefing page. Four Mk-20, but the ship still floats.

Figure 39: "La Combattante II" hit by several bomblets but still floating.

2.14.2 GROUND VEHICLES

Lastly, I tested against ground vehicles, which have a simpler damage model.

Damage on ground vehicles still have some effect. The most visible is the ability to fire at all. There may be more effects not immediately visible (e.g. precision).

Normal operation. Employing primary and secondary weapon.

Not firing, the turret still moves.

Figure 40 shows the effect of two Mk-20 Rockeye delivered in pairs over three targets: a BMP-3, a T-55 and a T-90. "Soft-skinned" vehicles such as the BMP are easily destroyed. The T-55 was killed too, but the T-90 was still operative, albeit at half HP.

Figure 40: Effect of two Mk-20 Rockeyes versus different targets.

DCS needs a serious overhaul of the damage model (and path finding too). It would have much more depth and complexity to the game, and probably make even Combined Arms a module worth playing as tank drivers. At the moment, it is an interesting combination of RTS and direct control, but really shines only when players act as human JTACs from vehicles and controlling basic movements and artillery.

3. AVIONICS I: FIRST LOOK

This chapter gives a quick look at the F-14 Tomcat in DCS, its cockpit and avionics, and the different aircraft flyable and included in the module.

3.1 F-14 TOMCAT: REAL LIFE AND DCS

Four versions of the F-14 are available in DCS. At the moment of writing, the F-14A "Late" and the F-14B are flyable but, eventually, four models will be playable[15]:

1. F-14A-95-GR, IIAF / IRIAF[16] (Late 70s to Early 80s);
2. F-14A-135-GR "Early" (Late 70s to Early/Mid 90s)[17];
3. F-14A-135-GR "Late" (Late 80s / Early 90s to Late 90s / Early 2000s);
4. F-14B (Late 80s / Early 90s to Late 90s / Early 2000s).

The main difference between the F-14A and the F-14B (formerly F-14A+) is the pair of engines thrusting the aircraft. The B is powered by two General Electrics F110-GE-400, the Tomcat-A by two Pratt & Whitney TF30-P-414A.

The TF30 was converted from an airline engine and painfully underpowered[18]. It was meant as a temporary solution until a better replacement could be found. Its performance meant that CV and land take-offs were conducted in full afterburner. This procedure was later amended when the F110 was introduced to use military power, which is also safer in case of engine failure to reduce the thrust asymmetry.

On the other hand, in certain conditions, the TF30 was capable of delivering excellent performance: in fact, it powered the F-111 "Aardvark", giving the

15 Periods are described in the F-14 Tomcat module's FAQ – Source: ED Forum.
16 Imperial Iranian Air Force. Now Islamic Republic of Iran Air Force, since the revolution of 1979. Iran received the F-14 starting January 1976.
17 Representing the F-14 from the late '70s to the early '80s. Source: gyrovague – r/hoggit.
18 From former F-14A RIO "Spanky" AMA on reddit. Source: /r/hoggit

aircraft remarkable low-level speed, but it suffered when faced with the fast throttle changes and the high AoA[19] manoeuvres required to a fighter jet, due to tendency of stalling in such conditions.
Nevertheless, eventually the top speed was limited to Mach 1.88:

> *I think the 1.88 limit was for directional stability with an engine out. Lose a motor at that speed and the rudders and SAS would be overwhelmed.*
> *You'd lose the jet, perhaps catastrophically.*
>
> **PARSONS, DAVE; HALL, GEORGE; LAWSON, BOB. GRUMMAN F-14 TOMCAT: BYE-BYE, BABY..! (P. 154).**

Besides the engines, the three F-14A show differences in terms of avionics:

- F-14A IRIAF: AN/ALR-45 RWR, no TCS, no LINK4, no ICLS/ACLS, no LANTIRN pod, older weapons (no AIM-9M, no AIM-7 F, M, MH, P; no AIM-54A Mk60 or AIM-54C Mk47);
- F-14A Early: AN/ALR-45 RWR and AN/ALR-50 MWR;
- F-14A Late (same as B, besides the engines): AN/ALR-67.

More information can be found in the F-14 FAQ page in Eagle Dynamics' forum.

3.1.1 THE IRANIAN F-14 TOMCAT

The first F-14 delivered to Iran date January 1976, and their were different from the ones in service in US Navy[20]:

- AWG-9: slightly different computing performance (allegedly);
- no IRST: briefly used by the US Navy themselves due its poor performance, the plan was waiting for the new TCS (equipped on the F-14A "Late" and the F-14B in DCS). It was introduced in 1980 but, by then, the revolution had already happened.
- ECM: the suite installed was downgraded (still to be determined what effect it will have in DCS – if it will have any effect in the first place);
- engines: the Pratt & Whitney TF30-PW-414 were installed. They less prone to stall compared to the earlier -412.
- armament: AIM-9P, AIM-54A and AIM-7E-4.
- others: Iranian Tomcats lacked the KY-28 and the carrier-optimised ILS system.

19 Angle of Attack: is the angle between a reference line on a body (often the chord line of an airfoil) and the vector representing the relative motion between the body and the fluid through which it is moving.

20 Main source: Iranian F-14 Tomcat Units in Combat – Tom Cooper and Farzad Bishop (Osprey Publishing).

> **Note**: the features of the Iranian F-14s in DCS, when the aircraft is implemented, may differ from the specs above.

3.1.2 TF30 VS F110 IN DCS

The TF30 was the original, yet unintended, engine the F-14 program had to adopt. Notorious for its issues and limitations, it was definitely not the most beloved by the crews.

> *The Tom deserved better than the TF30 – they should court-martial those who said it'd be good enough.*
>
> **PARSONS, DAVE; HALL, GEORGE; LAWSON, BOB. GRUMMAN F-14 TOMCAT: BYE-BYE, BABY..! (P. 154).**

When it comes to DCS, the difference between the two engines is well described by the manual:

> *The main difference between the TF30 and F110 engines (apart from lesser thrust in the TF30s) is that the TF30s are more sensitive to the quality of the airflow entering the compressor face. In general it is wise to avoid anything less than military power or afterburner while in high angle of attack maneuvers as well as avoiding large rudder inputs or asymmetric engine throttle settings. That said, the TF30s in the HB F-14A module have been extensively tuned using available data and SME expertise, resulting in an accurate modelling of an engine undeserving of its bad reputation. One "advantage" of the TF30's mechanical fuel control is its high speed thrust, resulting in higher top speeds than the F110 can achieve. If flown within normal parameters, the TF30 engines behave well if a tad underpowered compared to the F110s.*
>
> **DCS F-14 MANUAL**

TF30 LOW ALTITUDE PERFORMANCE – PRACTICAL TESTS

> **Note**: a recent DCS patch[21] as introduced the long-awaited performance adjustments to the F-14A and F-14B. Before this patch, the F-14A struggled to get past Mach 1, along suffering from other issues. This was acknowledged by the devs, and the worked hard to prepare this beefy FM update.

The TF30 has the peculiar behaviour of "happily chewing all the air it can get" (quoting a friend). It will therefore push more as more air it gets. The result is an impressive performance in some scenarios.

21 Open Beta 2.7.7.14727. Patch Notes.

The following are two simple tests to have an idea of the top speed of a few DCS aircraft at low level. The tests are conducted at 3,000ft, with 10,000 lbs of internal fuel (when possible, otherwise 7,000 lbs) and with the aircraft payload default from the editor. The modus operandi is simple: spawn the aircraft, activate the Altitude Hold autopilot, smash the throttles, wait 3’30” and collect the speed value.
The goal is not have a precise measurement, rather an idea of the TF30 performs down below, so that pilots can adjust and take advantage of its strengths.

Test I: Top Speed

The first test is a simple measurement of the top speed. These are the results:

Note: I initially gathered the IAS value rather than the TAS, so I later converted it to TAS and then Mach using this tool.

AIRCRAFT	FUEL	IAS	MACH
AV-8B	7000 lbs	597	0.956
F-16C	7000 lbs	772	1.236
Viggen	10000 lbs	841	1.347
Mirage 2000C	7000 lbs	792	1.268
F/A-18C	10000 lbs	688	1.101
Su-27	10000 lbs	784	1.256
F-15C	10000 lbs	785	1.257
MiG-29A	7000 lbs	841	1.347
F-14A	10000 lbs	898	1.437
F-14B	10000 lbs	767	1.228

The top speed of the F-14A is **incredible**! Other interesting observations include:

- the MiG-29A was running on fuel fumes at the end of the test;
- the Su-27 blew up shortly after the end of the test. As Betty complained about reaching the max speed, the nose oscillated with increase amplitude and frequency until the aircraft exploded;

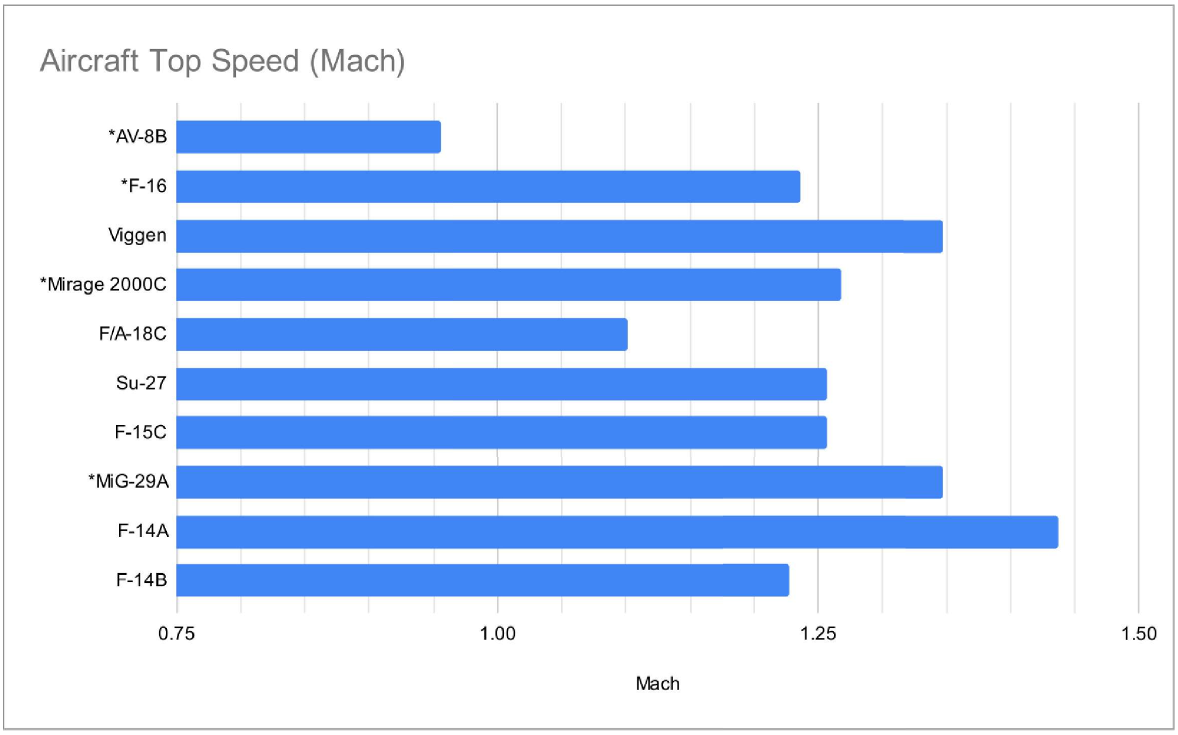


Figure 41: Test - Aircraft top speed.

Test II: Acceleration To Max Speed

The test above highlights the incredible top speed of the F-14A. However, a great top speed is not that useful if it takes a day to get there.

The second test aims to provide a better overview of the acceleration characteristics of the F-14A and F-14B compared to two other popular modules: the F-16C and the F/A-18C.

The scenario is the same used in the previous test, values are collected every 15”.

TIME	F-14A	F-14B	F-16C	F/A-18C
0”	0.657	0.657	0.657	0.657
15”	0.868	0.875	0.999	0.819
30”	1.077	1.054	1.146	1.014
45”	1.192	1.147	1.188	1.062
1’00”	1.248	1.19	1.205	1.083
1’15”	1.295	1.21	1.214	1.092
1’30”	1.334	1.222	1.219	1.097
1’45”	1.37	1.227	1.221	1.098
2’00”	1.404	1.228	1.225	1.1

2’15”	1.424	1.23	1.23	1.1
2’30”	1.431	1.23	1.233	1.1
2’45”	1.436	1.228	1.236	1.1
3’00”	1.437	1.228	1.24	1.1
3’15”	1.437	1.228	1.247	1.1
3’30”	1.437	1.228	1.251	1.1

Figure 42 better highlights the different acceleration from 430 kts TAS to the max speed of each aircraft. The F-14A and F-14B show a similar pattern through the ingress into the transonic region (0.8 < VF14 < 1.2, measured in Mach), but diverge as the aircraft become supersonic.

In fact, as the F-14A exits the transonic region, it starts another accelerating phase, culminating with the max speed of ~M1.4.

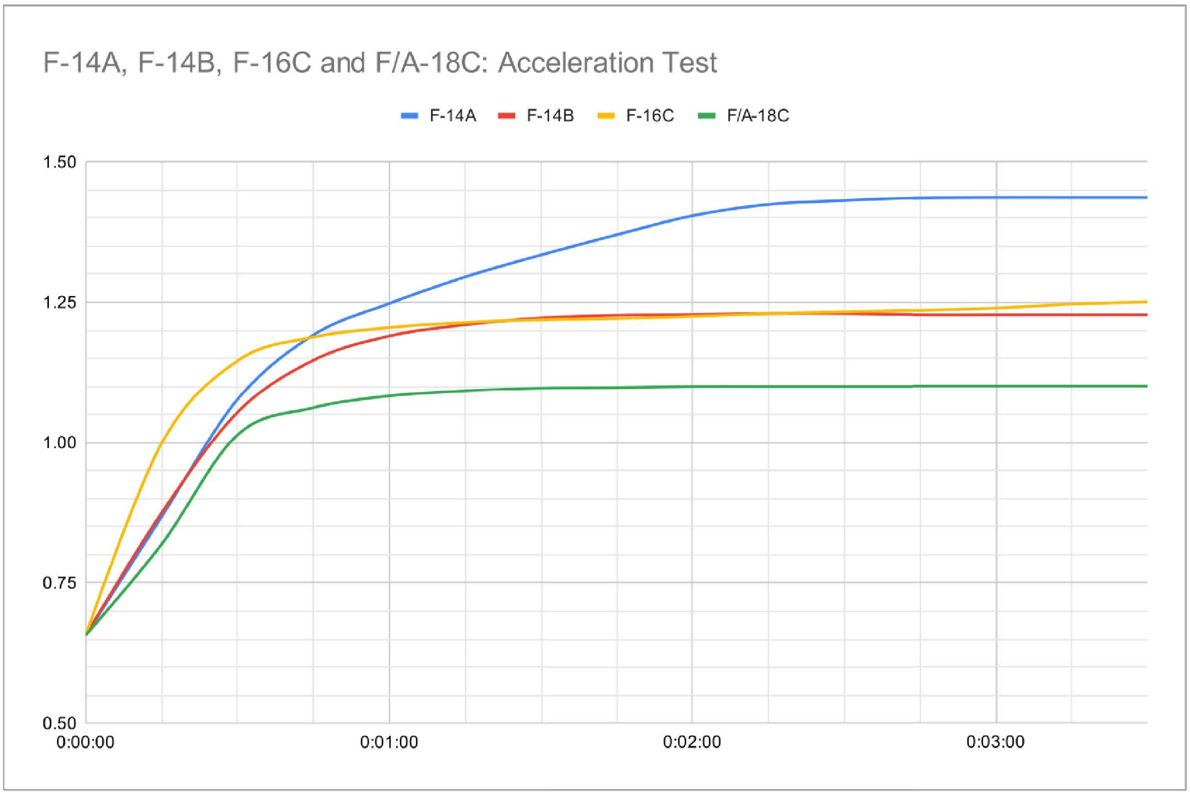


Figure 42: Test - Aircraft acceleration (Mach vs Time).

Test III: Acceleration From Low Speed

The previous two tests confirm the assumptions about the TF30 vs the 110: the more air it gets, the happier it is. However, what happens when the F-14A is slow, because of the situation or a mistake made by the pilot?

To better appreciate the acceleration from low speed, I modified the scenario and introduced for new aircraft, spawning at 3,000ft with the same payload and fuel as the previous, but starting from 250 kts. I then recorded the speed every 5”.

The test is the least accurate as the Altitude Hold autopilot in the F-14 is hard to latch in those situations. However, slowing down the time to ¼ or less helps to maintain a good profile and get acceptable readings. As per the previous tests, the goal is getting a better idea, not finding the exact values.

TIME	F-14A	F-14B	F-16C	F/A-18C
0”	0.382	0.382	0.382	0.382
5”	0.438	0.501	0.5	0.469
10”	0.525	0.625	0.631	0.57
15”	0.62	0.744	0.761	0.678
20”	0.729	0.857	0.884	0.797
25”	0.839	0.953	0.988	0.894
30”	0.923	1.014	1.053	0.962

Figure 43 allows to better appreciate the drawbacks of the TF30: not only it is affected by rapid throttle changes much more than the F110, it is also less powerful, and this can be a problem when the speed drops.

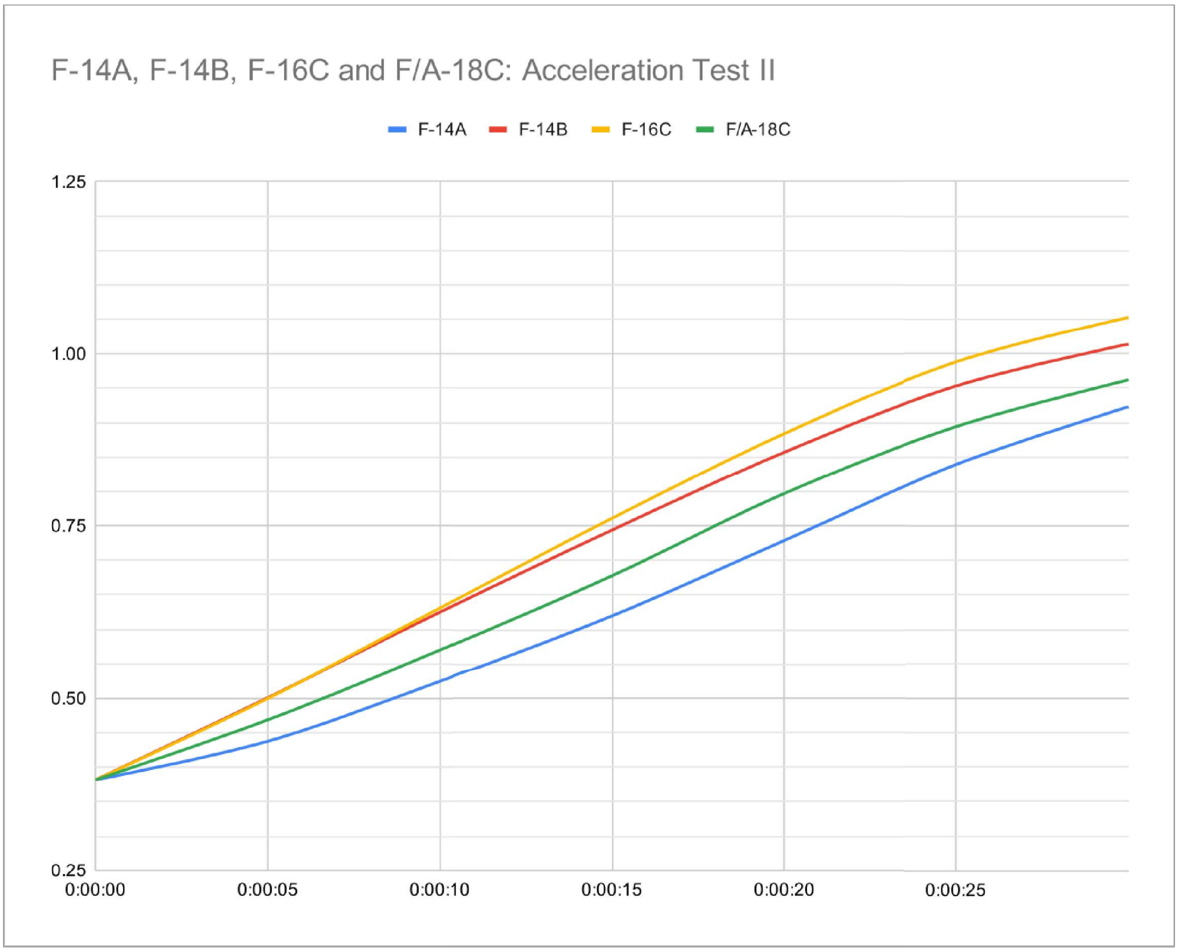


Figure 43: Test - Aircraft acceleration from low speed (Mach vs Time).

Conclusions

The TF30 and the F110 both has pros and cons. The former pushes the F-14 much faster in the end, but its performance when the initial speed is low is really subpar. The latter is a "smoother" engine overall, not as temperamental, and delivers more thrust when it is needed the most (accelerating from low speed).
Per sé, the TF30 is not a bad engine, but the pilot has to be extra careful, and manage the speed with greater care.

3.1.3 AN/ALR-45/50 VS AN/ALR-67

The two sets of devices are the primary means to create Situational Awareness passively. The rely, in fact, on the radar emissions of other aircraft, radar stations, active missiles and so on.

> Note: The documentation about the AN/ALR-45 and AN/ALR-50 is not available in the manual at the moment of writing. This paragraph and Chapter 6.8.3 will be expanded later.

The difference between the devices is brilliantly summarised by Cobra on ED's forum:

The Heatblur F-14B is equipped with the ALR-67 – a standard modern RWR used by the US Navy in the '90s. It combines over 30 years of experience in signal processing, computing, and intelligence and it represents the third generation of the radar warning receivers.
On the other hand, the standard equipment on the F-14A since it entered the fleet was the ALR-45 radar warning receiver with the ALR-50 missile warning receiver. This set was introduced to the fleet in the early '70s, and it represented the dusk of the first generation of the radar warning receivers. While the capabilities of the ALR-45/50 were sufficient for the end of the Vietnam War Era, they became annoyingly inadequate in the '90s.
Compared with the ALR-67, ALR-45/50 isn't a full-digital RWR. The receiver wavelength spectrum is narrower (2-18 GHz) compared to the ALR-67 (0.5-20 GHz). The system is unable to perform threat identification or prioritization. Registered emissions are presented on a circular display as strobes, with the length of each strobe representing the strength of the signal. In addition to that, the RIO has a set of warning lights for selected threats: SA-2, SA-3, SA-4, SA-6, AI (airborne interceptor) and AAA. They are lit when a corresponding threat is detected.
With the ALR-45/50, the information provided to the crew is limited and raw. It requires more experienced crew and more attention during a mission to build a similar level of situational awareness when compared with the ALR-67. On the other hand, a skilled RIO can benefit from being able to read raw signal readings and for example, estimate the distance to the threat from the length of the strobe.

COBRA847, EAGLE DYNAMICS FORUM

3.1.4 THE F-14 RETIREMENT: LOST CAPABILITIES

The retirement of the F-14 Tomcat left a partial gap in the ability of the US Navy to fulfil some missions with the same performances. For example, the Fleet Defence task fell onto the Hornets' shoulder, but several criticised its lack of endurance, raw power and the shorter range of the AMRAAM. On the other hand, the main threat and adversary of the US Navy collapsed at the beginning of the 1990s (moreover, the Hornet improved, and it is still improving, as it matures).

Many former F-14 crews, several later repurposed as Hornet or other pilots and WSOs, remember the advantages in terms of speed, endurance and, in case of the late F-14B and F-14D, capability, of the Tomcat.

For example, episode 11 of "*The F-14 Tomcast*", talks about the incredible capability of the F-14D, and has a couple of examples of the strenghts of the F-14 vs other assets.

In particular, at 1h14', the F-14D showed superior capability over the Hornets by being able to operate in very difficult situations, whilst the Hornets had to go back to the Carrier.
No spoilers, watch the video! :)

> *On the way up, my new B-model remained in locked combat spread, mil power, while our strike lead in his F/A-18C required full burner to make the climb to our 27,000-foot roll-in point.*
> *[..] In the debrief we learned that we had both been shot at by SA-3 missiles [..] the assembled strike participants watched with mouths open as a little coffin appeared around the strike lead's Hornet, while "our" simulated missile ran out of gas before catching the Screaming Cat!*
>
> **PARSONS, DAVE; HALL, GEORGE; LAWSON, BOB. GRUMMAN F-14 TOMCAT: BYE-BYE, BABY..! (PP. 137-138).**

3.2 FIRST LOOK AT THE COCKPIT

The first impression of the back seat can be intimidating: a big round display, a smaller one, all surrounded by buttons, knobs, and switches. An effective way to simplify it, is breaking it down into macro-parts, then in smaller sections and eventually in the single bits of the avionics.

The first iteration is simple:

- **Left** (Red): Radio and TACAN, plus the *mechanical controls* for the Antenna and the weapons configuration. In also includes the main manual data input to the WCS (CAP);
- **Centre** (Green): comprising the two displays, the stick and the surrounding controls. This is where most of the *software controls* of the radar are located, and the stick is one of the main interfaces to the avionics;
- **Right** (Blue): Datalink and defensive systems (such as RWR, Countermeasures, IFF). The stick is controlled with the right hand, so this part of the cockpit is usually set at the beginning of the flight and then left mostly undisturbed.

When you are looking for a specific function, start from this model, then move to the next level (division in consoles and panels), and eventually, you should be able to find what you are looking for.

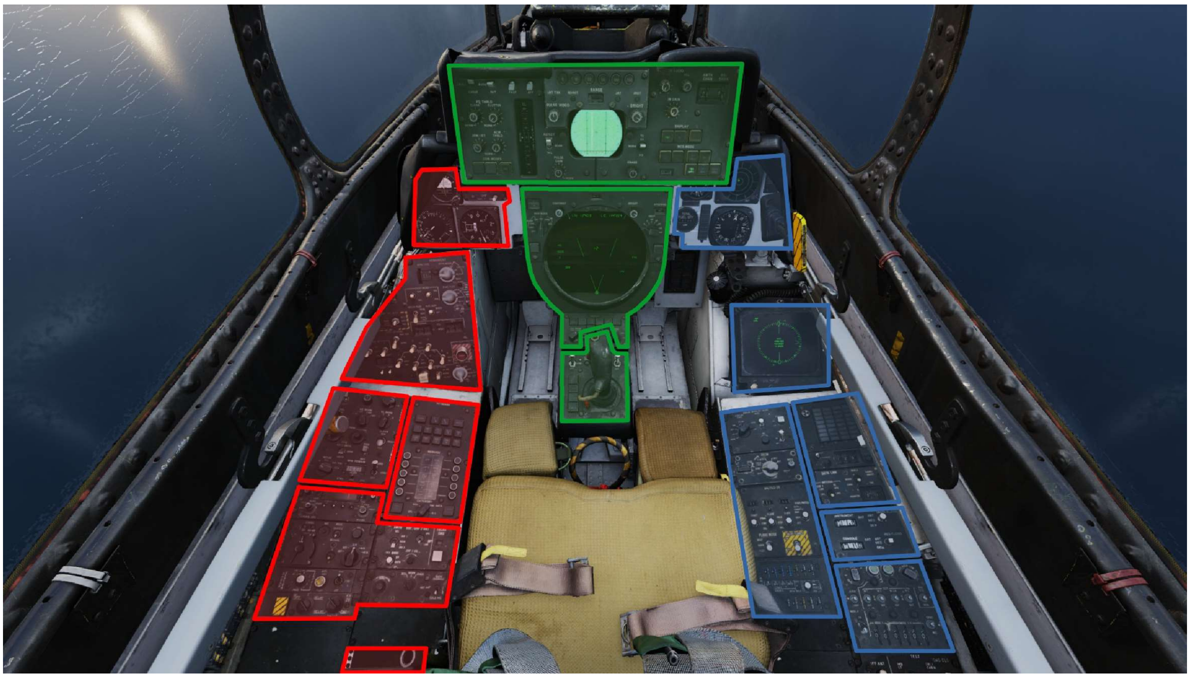


Figure 44: First look at the RIO's office.

Once you have a general idea of where you can find what, you can jump a level deeper.

The following subdivision wraps together instruments with somewhat similar functions (such as DECM and Countermeasures).

This is still a very superficial look at the avionics, some controls are omitted if not directly clickable (such as the Push-To-Talk controls on the pedals or the Countermeasures dispense switches placed above the DDD).

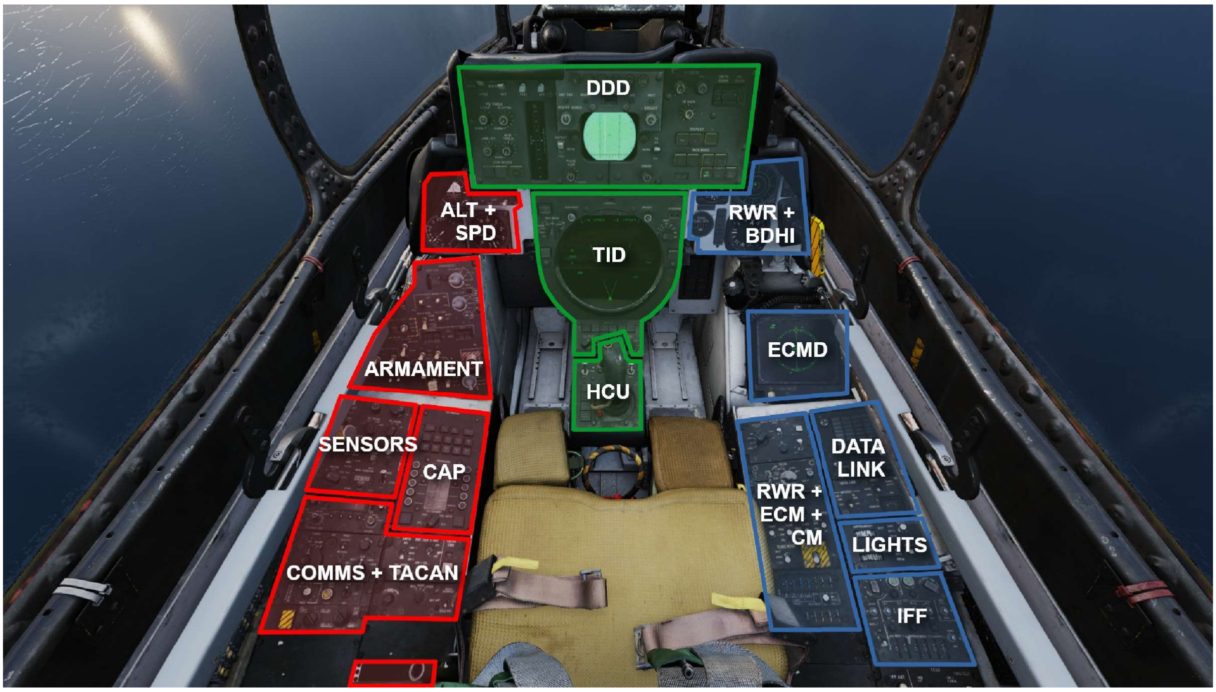


Figure 45: Cockpit layout - Details.

Starting from the bottom-left, in clockwise order we find panels containing:

1. *Comms + TACAN*: ARC-182 VHF/UHF, the TACAN controls, the intercom (ICS) panel;
2. *Sensors*: controls for slewing the antenna, along bars and azimuth (how "tall" and "wide" the radar volume is). The panel also contains controls for the Television Camera Set (TCS);
3. *CAP*: The Computer Address Panel is the main input method, it consists in a keypad, along a selection menu that resembles an analogue version of an MFD, with different pages selectable via a knob;
4. *Armament*: this panel contains most of the functions used in Air-to-Ground missions, on top of payload jettison controls and some switches dedicated to the AIM-7 and the AIM-54;
5. *ALT + SPD*: in this area the gauges showing the current barometric altitude and speed are located. There is also an attitude indicator and the repeater of the radio frequency selected by the pilot;
6. *DDD*: this is where most of the radar settings are located, such as radar mode, filters and the main AWG-9 radar display (Detail Data Display);
7. *TID*: the Tactical Information Display, or "fishbowl" is a large display showing multiple information depending on the mode selected and the inputs from the CAP. It also show the images from the TCS and the LANTIRN, and displays Datalinked targets.
   The pilot can repeat its content in the front seat;
8. *HCU*: the Hand Control Unit allows the RIO to mark targets, obtain information about contacts from the DDD and contacts and waypoints from the TID, and much more. It can also be used to move the TCS;
9. *RWR + BDHI*: The Radar Warning Receiver display is located there, along the Bearing Distance Heading Indicator. This area also includes a clock and a fuel quantity totalizer, along the canopy ejection handle.
   Below this panel, not indicated in the representation, there is the Cautionary advisory panel, showing issues such as the AWG-9 Cooling not activated;
10. *ECMD*: the display shows navigational information in the F-14s equipped with AN/ALR-67. For the others, it displays information about the AN/ALR-45;
11. *RWR + ECM + CM*: this area includes the controls for the Radar Warning Receiver, the Defensive ECM and the conventional countermeasures (Chaffs, Flares and Jammer. Jammers are not implemented in DCS at the moment);
12. *Datalink*: the set of lights in the top part of this panel display messages sent via Datalink. It is mostly non-functional, due to DCS limitations.
    The bottom part includes the Datalink frequency and mode, along other settings;
13. *Lights*: this is where the controls for the internal lights are located;

14. *IFF*: most of the IFF functionalities are not implemented in DCS. However, some are thanks to DCS-SRS. The IFF is configurable by means of this panel.

3.3 BACKSEAT RUN-THROUGH

This chapter is a short overview of the avionics, highlighting in a few words the purpose and whether a new player can skip the system for the moment. Eventually, a complete Radar Intercept Office, should know every switch and button of the aircraft!

Additional details of the most important parts of the avionics are discussed in Chapter 4.

Notes: The title of each part links to Heatblur's manual.
The red boxes indicate some useful control that, if possible, should be assigned to the controllers.

3.3.1 LEFT PANELS AND CONTROLS

The controls located in this section of the cockpit are discussed from the bottom-up.

Figure 46: Cockpit run-through - Left panel.

Figure 47: KY-28 Control Panel.

KY-28 CONTROL PANEL

This panel controls the comms encryption. Its normal mode of operation in DCS is *P/OFF*, thus disabled. The radio encryption can be used in conjunction with SRS (SimpleRadio Standalone).

Usage: The KY-28 was widely used during the Vietnam conflict until the 80s. It is considered by many unsuccessful as it introduced delays, reduced the performance of the radio and degraded the quality of the transmission.
Definitely one of the panels used less often.

Figure 48: Radar Beacon Control Panel.

RADAR BEACON CONTROL PANEL

Used to enable the ACLS (Automatic Carrier Landing System). Its function is controlled by the Pilot in the front seat.

Usage: The AN/APN-154 radar beacon requires LINK4 datalink.

Figure 49: ICS Control Panel.

ICS CONTROL PANEL

This panel contains most of the controls related to the ICS (Intercommunications System). This is the primary means of communication between Pilot and RIO.

Usage: The recommended and default setting is *COLD MIC*. *HOT MIC* used to suffer from comms lag, and also broadcasts every background noise picked by the microphone.
If you can't use pedals as PTTs, switching to *HOT MIC* can free you from the necessity of holding the ICS PTT during particularly demanding phases.

Figure 50: Communication / TACAN Command Panel.

COMMUNICATION / TACAN COMMAND PANEL

This panel contains a series of controls affecting comms and TACAN.
Note that the KY-58 is not implemented in DCS (*KY MODE* switch).

Usage: The most important parts of this panel are the *XMTR SEL* switch, which controls the output of the Radio PTT (the other PTT is the ICS) and the *TACAN CMD*, which toggles the TACAN control between the Pilot and the Radar Intercept Officer.
The XMTR is fundamental to quickly jump between various agencies (e.g. GCI / AIC) and the wingmen.

XMTR SEL [UHF1] / [UHF2]

TACAN CONTROL PANEL

Figure 51: TACAN Control Panel.

TACAN interface for the RIO, although there is only one of such devices in the F-14.
Who controls the TACAN is defined by the TACAN CMD button in the Communication/TACAN Command Panel (see Figure 50).

Usage: The TACAN functionalities are discussed more in depth later in the book.

LIQUID COOLING CONTROL PANEL

Figure 52: Liquid Cooling Control Panel.

This switch controls the cooling circuits of either the AWG-9, the AIM-54, or both. Its location makes it hard to read with the ejection lever in the default position.

Usage: This three-way switch should be set according to the loadout: if AIM-54 Phoenix are used, the switch should be set in the forward position, otherwise the aft position.

Notes: the real AIM-54C is sealed and should not require external cooling.
I'm not sure whether this is implemented or not.

AN/ARC-182 V/UHF 2 RADIO

Figure 53: AN/ARC-182 V/UHF 2 Radio.

Both crew members can use both radios through dedicated PTT or Mic input selector. Compared to the pilot's radio, this support VHF frequencies and ADF.

Usage: During the startup, the radio is activated, and the RIO can select if the Guard

frequency (243.000) should be monitored as well (*T/R* or *T/R+G*).
Although both "Forward" and "Aft" radio provides ADF (Automatic Direction Finder) in real life, in DCS only the Aft has it. This task thus falls on the RIO.
Both radios can display radio presets (configured in the Mission Editor) or the frequency selected.

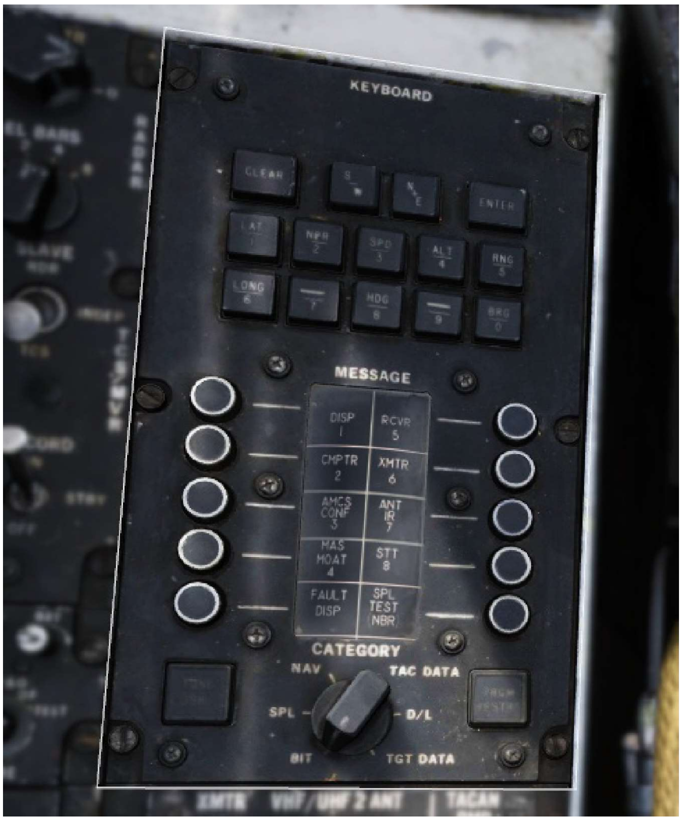


Figure 54: Computer Address Panel.

COMPUTER ADDRESS PANEL

One of the main interfaces between the Radar Intercept Officer and the avionics, the CAP is discussed more in-depth in Chapter 4.1.1 .
It is composed by a dual-function Keyboard (both standard numpad and function selector), plus a sort of manually-scrolled MFD: the pages are selected by the knob located at the bottom of the CAP, and the function of interested by means of the two columns of round button.

Usage: As understandable, the CAP usage depends on the information or function required in the current phase of the flight.
As a rule of thumb, it since there is no way to "undo" the inputs and that it is quite easy to corrupt the avionics in almost non-recoverable means when in flight, I strongly advise pressing *CLEAR* button should be pressed every time the Keyboard is used. After a while, it becomes a habit, part of the natural input process.

> **Ideally all of it?**

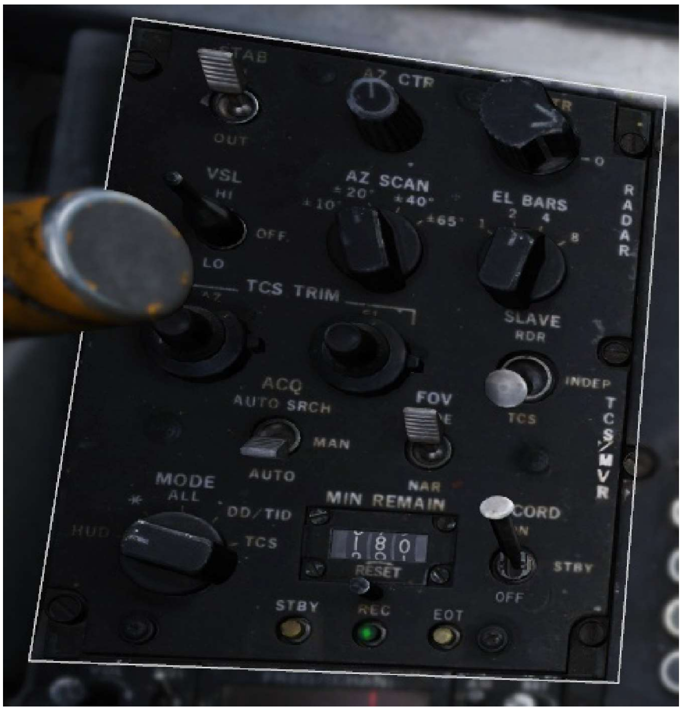


Figure 55: Sensor Control Panel.

SENSOR CONTROL PANEL

This panel is fundamental for the daily job of the Radar Intercept Officer. The top six controls set how the radar operates. From the top-right, clockwise:

- *STAB*: controls if the elevation uses the horizon or the aircraft as reference (ground stabilization). It can be overridden by the WCS in certain radar modes (e.g. PD modes such as Track-While-Scan);
- *AZ CTR*: controls the horizontal orientation of the antenna (azimuth);
- *EL CTR*: controls the elevation angle of the antenna;
- *EL BARS:* sets the number of bars. More bars equal wider volume (vertically);
- *AZ SCAN*: set the azimuth width;
- *VSL*: sets the Vertical Scan Lock mode, HI or LO. Useful at short range or to pre-set the radar before handling its control over to the Pilot.

The other controls are less used. Part control the TCS (Television Camera Set), such as the *TCS TRIM*, to adjust its default position or how the relation between radar and TCS work (*SLAVE*), the *FOV* or the acquisition method (*ACQ*).

The bottom row of controls the recording tape (AVTR – Airborne Video Tape Recorder). The controls are implemented but have no actual function.

AZ CTR [CCW] / [CW] + Re-centre
EL CTR [CCW] / [CW] + Re-centre
AZ SCAN [CCW] / [CW]
EL BARS [CCW] / [CW]

Figure 56: Eject Command Lever.

EJECT COMMAND LEVER

If the Pilot starts the ejection, both crew members are ejected (understandable, I guess!).
This lever controls the effect of the RIO initiating the ejection sequence.

- *Forward (PILOT mode)*: only the RIO will be ejected;
- *Aft (MCO mode)*: both crew members are ejected.

Before proceeding to the next console, note the 2-way switch that regulates the oxygen flow in the RIO mask. It is located behind (or to the left, depending on the point of view) of the *ICS Control Panel*.
It is fundamental to avoid the symptoms of hypoxia.

Figure 57: Oxygen valve switch.

3.3.2 ARMAMENT PANEL

The Armament Panel includes several controls, some related to Air-to-Ground operations, other Air-to-Air, on top of the stations jettison and emergency jettison.

Figure 58: Cockpit run-through - Armament panel.

For the purpose of this chapter, the Panel is separated into three blocks:

1. Air-to-Ground delivery settings;
2. Jettison and Stations selections;
3. Air-to-Air settings.

The Armament Panel is introduced in the F-14 Manual by Heatblur at this page.

AIR-TO-GROUND DELIVERY SETTINGS

Figure 59: Armament Options.

ARMAMENT OPTIONS

The top-right area of the console includes most of the Air-to-Ground related controls, from the fuze settings, to the weapon in use and the delivery type.

The details of the settings are discussed later in Chapter 12 and subsequent. However, two points should be evident:

- the pilot has no control on which Air-to-Ground weapon is dropped, and its settings;
- the ripple options do not provide a distance measurement, so the RIO has to calculate it himself, if necessary (there are dedicated tables for the purpose).

> **Note**: there is an option in the special options of the module to enable the display of the selected weapon on the TID. This can be useful for any crew, especially pilots relying on Jester.
> This feature is not present in the real Tactical Information Display.

STATIONS SELECTION AND JETTISON

The left part of the Console contains a set of switches, one for each station (but only one for station #1 and #8), and station #2 and #7 (fuel tanks) have a separated location on the left side. The switches enable the station for delivery or jettison.
Payload jettison can be doe selectively or all in one go in case of emergency.

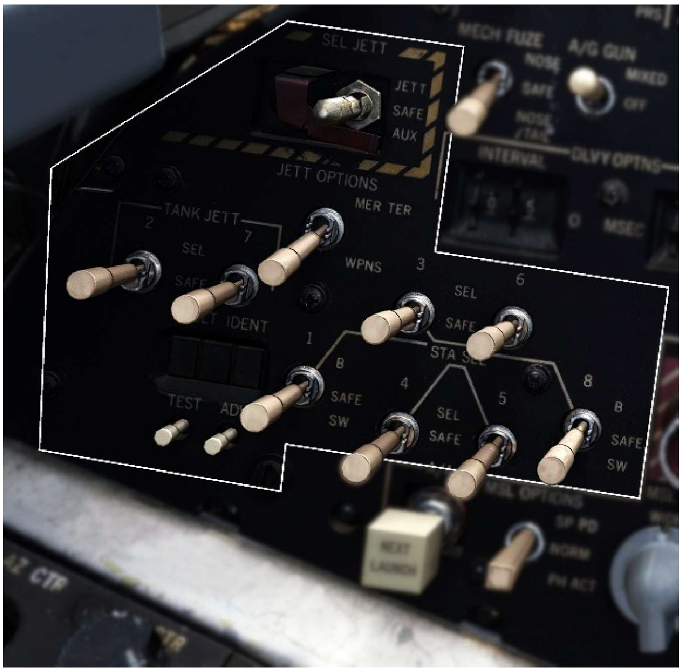


Figure 60: Stations selection and jettison.

Usage: If defending from a serious threat or no AAR (Air-to-Air refuelling) is planned, the fuel tanks can be jettisoned, drastically reducing the drag. The same is applicable for other ordnance, especially bombs, if attacked by a fighter or other threat.
When jettisoning the payload, the pylons can be sometimes jettisoned too. Being this a game, and no cost or maintenance time is required to refit them, this is usually a good idea. Note that I am uncertain whether the jettison of the pylons affects drag and weight.
This topic is discussed in greater detail in Chapter 4.5.

AIR-TO-AIR SETTINGS

The bottom-right corner of the console hosts the Air-to-Air controls. Some of the most important commands are located here, such as the LAUNCH button (the backlighting is activate when the crew has launch authority), the *NEXT LAUNCH* button to control the priority queue auto-generated by the WCS.

Figure 61: A/A settings.

Careful when playing with the *NEXT LAUNCH* options: if the track is lost, the WCS takes over again and changes the order again. It can easily lead to a blue-on-blue without proper geometry or deconfliction.
The *MSL SPD GATE* is not modelled as it is beyond the fidelity of the air-to-air missiles in

DCS, at the moment.[22]

In real-life, these are the effects of the selector switch:

- *WIDE*: only used with the AIM-7 and there is no radar lock with the target. The PD frequency sweeps the entire missile radar frequency range;
- *NAR*: used with the AIM-7, but only the Sparrow's frequency range are swept;
- *NOSE*, *NOSE QTR*, *TAIL QTR* and *TAIL* are used to inform the WCS that the target is locked on a position matching the switch.

The *MSL OPTIONS* three-way switch is partially implemented. In real life, these are the related functions:

- *SP PD*: used only with the AIM-7F, causing it to operate in PD mode;
- *NORM*: default position for both AIM-54 and AIM-7. The sparrow in CW (Continuous Wave) mode;
- *PH ACT*: used only with the AIM-54 missile, it causes the WCS to switch from semiactive guidance to active guidance, and commands the AIM-54's radar to operate in short-range mode.

In DCS, only the PH ACT function partially works, and can command the WCS to send the activation command to the AIM-54 after it is launched.

LAUNCH [PRESS]
NEXT LAUNCH [PRESS]

3.3.3 TOP PANELS

This part of the cockpit includes most of the controls necessary to change the logic of the radar, whereas the precedent (Chapter 3.3.1) actioned the physical position of the antenna.

Figure 62: Cockpit run-through - Top Panels.

22 Source – Naquaii via PM. Thanks mate!

The DDD (Detail Data Display), conveniently placed in the centre, provide a handy means of separating and regrouping the controls:

- Left side: different parameters and ECM controls;
- Centre: DDD and related controls;
- Right side: IR, missile settings and radar modes.

TOP PANELS: LEFT SIDE

Figure 63: Top Panels, Left side.

Some of the controls in this panel are not implemented, namely the ones related to the ECM.

The most frequently used switches are the *TGTS* switch, which controls “when” the AIM-54 is commanded active by the WCS, and the *MLC* switch, that controls whether the Mainlobe Clutter Filter is active, deactivated or automatically controlled by the WCS.

TOP PANELS: CENTRE

Figure 64: Top Panels, Centre.

The Detail Data Display (DDD) dominates the console.
Most of the controls are related to the radar Pulse modes:

- top row sets the range;
- the knobs control how radar returns are displayed on the DDD.

TOP PANELS: RIGHT

The three knobs located in the top-right corner were used for the IRST mounted in the earlier versions of the F-14. They are not functional with the TCS mounted in the F-14B and in the available versions of the F-14A (at the moment of writing).

The two *CHAN* controls select the operating frequency of the AWG-9 and missiles and are not implemented either.

The collection of buttons below select the radar modes.

Figure 65: Top Panels, Right side.

Not every mode is selected automatically by the RIO. Notable examples:

- a broken PSTT lock reverts to Pulse Search;
- the WCS switches automatically from Track-While-Scan Manual to Track-While-Scan Auto when an AIM-54 is employed.

The rotary-drum in the bottom left corner of the console shows which radar mode is currently in use.

3.3.4 CENTRE-BOTTOM CONTROLS

This part is located right below the Tactical Information Display (TID), and includes a set of parameters for the “bowl”, on top of the Hand Control Unit (HCU) and related settings and controls.

The TID is covered in greater depth in Chapter 4.1.2 .

Figure 66: Cockpit run-through - Centre-bottom controls.

TACTICAL INFORMATION DISPLAY SETTINGS

The knobs control the TID mode and the maximum displayed range.

The top row helps to declutter the TID.

Figure 67: TID settings.

Note: disabling the representation of the LINK4-originated contacts help to hook the correct target, rather than the datalinked one.

TID MODE [GND STAB]
TID MODE [ATTK]
RANGE [all]

HAND CONTROL UNIT (HCU)

Along the HCU controls, this is where the WCS is activated. If you see a green light around the *WCS XMIT* switch, it does not mean that the radar is emitting (it happens to everyone..).

Figure 68: HCU controls.

The four vertical buttons define whether the HCU controls the TV, the radar, the DDD cursor or the TID.

HCU FUNCTIONS [RDR]
HCU FUNCTIONS [TID CURSOR]
HCU ELEV THUMBWHEEL [CCW, CW, recentre]
HCU TRIGGER [HALF and FULL ACTION]
HCU OFFSET [press]

3.3.5 RIGHT-SIDE CONSOLE

This area contains a great number of controls, less often used by the RIO, as his right hand controls the HCU, whereas the left is free to interact with the antenna settings and other controls.

Figure 69: Cockpit run-through - Right-side panels.

For example, this area includes controls for the:

- IFF;
- RWR;
- Countermeasures programs and settings;
- Electronic Countermeasures status;
- LINK4 Datalink;
- Cockpit illumination.

This overview starts from the bottom, then proceeds towards the top.

The tile of the Panel links directly to the manual of the F-14 Tomcat by Heatblur.

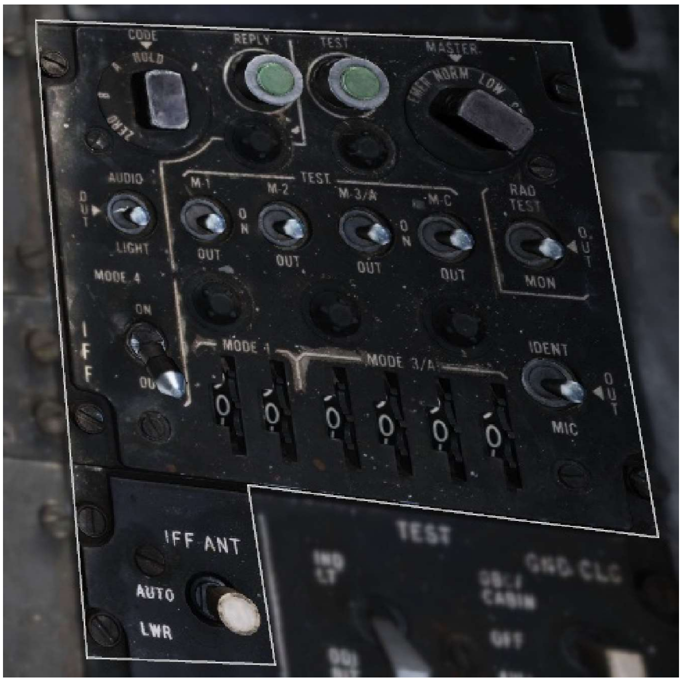


Figure 70: IFF Transponder Control Panel.

IFF TRANSPONDER CONTROL PANEL

Most of this panel is not used.
If you use SRS and LotATC instead, it can be used to activate the IFF and set the squawk code.

Usage: More information can be found in Chapter 21.4.

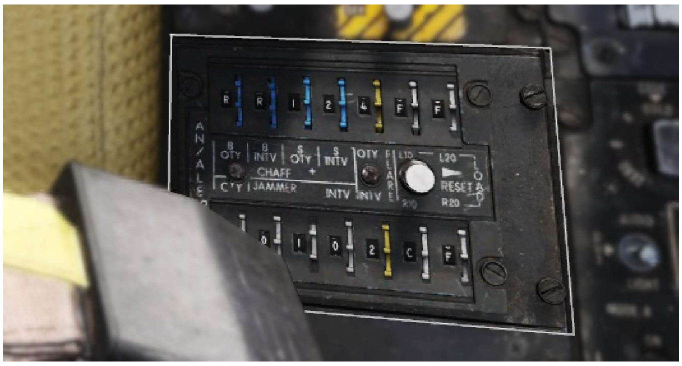


Figure 71: AN/ALE-39 Programmer.

AN/ALE-39 PROGRAMMER

This panel allows to set different combinations of countermeasures for the AN/ALE39.
The details of the CM to set in the first four thumbwheels from the right can be found in the kneeboard.

Usage: The programmer is used when a different configuration of countermeasures is loaded onto the aircraft, or to modify the release programs. Besides the former, I usually leave the Chaffs and only increase the Flare release program length to the maximum in air-to-ground operations. This ensures the release works automatically for longer, relieving the crew of a minor task in a potentially very delicate phase of a mission.
Note that Jammers are not implemented at the moment, so the crew can focus on only two countermeasure types.

Figure 72: Interior Light Control Panel.

INTERIOR LIGHT CONTROL PANEL

Straightforward, this is where the Radar Intercept Officer sets the internal lightning of the cockpit.

Note: Although unrelated to the Panel, the flash light is a very handy tool to look around when the pit is cold, or to better see the areas not properly illuminated.

Figure 73: AN/ALE-39 Control Panel.

AN/ALE-39 CONTROL PANEL

This panel sets what countermeasure is controlled by the Pilot (*FLARE MODE*), if the AN/ALE-39 is slaved to the AN/ALR-67 (*PWR/MODE*) and allows the RIO to start a release program.

Note: the *PWR/MODE* switch set to *AUTO(CHAFF)/MAN* is quite handy when merged, in the rare case where a radar-guided missile is employed. At longer ranges instead, it tends to only bleed faster through the limited amount of available chaffs.

CHAFF [SGL]
FLARE [SGL]

Figure 74: Data Link Reply and Antenna Control Panel and Data Link Control Panel.

DATA LINK CONTROL PANEL AND DATA LINK REPLY AND ANTENNA CONTROL PANEL

These panels allow to configure the LINK4A and LINK4C datalink modes, frequency and CV modes.

Usage: The LINK4 datalink is an old, non-secure, method of sharing information (even conceived as a means to remove or reduce voice comms). The F-14 supports two modes, LINK4A and LINK4C, selectable via the 3-way switch located in the top-right corner. "A" is the most common mode, enables communication and data-sharing between AWACS, Carrier and so on. The frequency always starts with the number 3, and the three other digits can be selected via the wheels on the top.
"C" is a fighter-to-fighter datalink, more limited, but enables features such a dedicated INS Fix update method.
The *MODE* switch has two positions:

- *CAINS/WAYPT*: used to receive INS alignment and other date when operating from a carrier;
- *TAC*: normal airborne mode. The switch moves automatically to this position if there are issues during the Carrier alignment.

Figure 75: DECM Control Panel.

DECM CONTROL PANEL

The implementation of the ECM in DCS is very limited, and has, at the moment, only the effect of partially reducing the range at which the aircraft can be locked.

Usage: Set to *STBY* during startup, then *REC* or *RPT* as required during the mission.

Figure 76: AN/ALR-67 Radar Warning Receiver Panel.

RADAR WARNING RECEIVER PANEL

Figure 76 shows the control panel of the AN/ALR-67, mounted in the F-14B and the F-14A-135 (Late).

Usage: Besides turning the device on and setting the volume and filter, the panel provides an Offset function. This is a useful way to temporarily separate and better

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visualize the threats identified by the RWR.

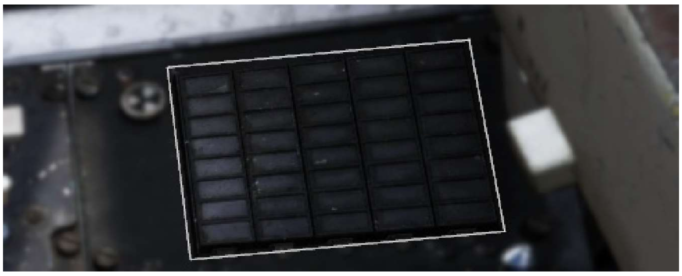

Figure 77: Digital Data Indicator (DDI).

DIGITAL DATA INDICATOR (DDI)

This panel contains a wide number of backlighted indicators. The vast majority of them are related to datalink functions unfortunately not implemented.

3.3.6 ADDITIONAL GAUGES, DISPLAYS AND CONTROLS

On top of the consoles and panels discussed before, the cockpit hosts a number of additional gauges, indicators, displays and controls. Most of them are present in both cockpits, either helping both crew members to monitor the other (for instance, checking the radio frequency set), or to provide Situational Awareness to both at the same time (e.g. the Radar Warning Receiver display, or the barometric altimeter).

Figure 78: Cockpit run-through - Additional gauges, displays and controls.

This overview covers the panels from left to right.

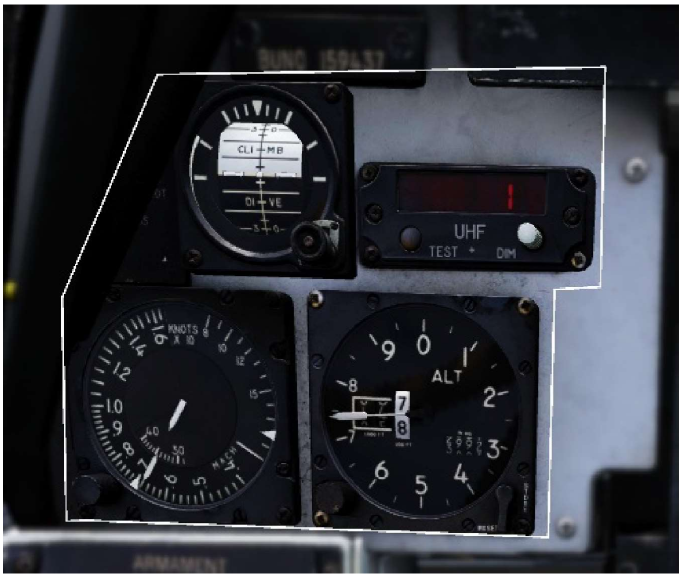

Figure 79: Left Instrument Panel.

LEFT INSTRUMENT PANEL

Along the Right Instrument Panel, this is a part of the cockpit the RIO should monitor. In contains:

- the standby attitude indicator (SAI);
- barometric altimeter;
- airspeed Mach indicator;
- UHF-1 remote indicator.

Figure 80: Right Instrument Panel.

RIGHT INSTRUMENT PANEL

The other side of the cockpit sports another set of fundamental indicators:

- total fuel quantity repeater;
- BDHI – Bearing Distance Heading Indicator;
- AN/ALR-67 display;
- Threat and Master Caution lights.

There is also a clock but it is basically invisible without Track IR, VR, or other head-tracking devices.

The Canopy Jettison Handle allows the Radar Intercept Officer to blow the canopy before ejecting, a step required in certain emergency conditions.

Figure 81: ECMD.

ELECTRONIC COUNTERMEASURES DISPLAY (ECMD)

This display is used for navigational purposes.
It is also used by the F-14A-135 (Early) and -95, equipped with the AN/ALR-45 (we'll know more once those two versions of the F-14 are released).

Figure 82: Caution-Advisory Panel.

CAUTION-ADVISORY PANEL

Contrary to the DDI, located in the Right Console and discussed in Chapter 3.3.5, the Caution-Advisory Panel refers statuses and messages pertinent to the aircraft.

Note: It is good habit, especially when new to the role, to have a look at this panel at the end of startup. It reminds the RIO to activate settings such as the Cooling for the AWG-9 / AIM-54.

3.4 IN-COCKPIT VISUAL REFERENCES

When flying as Radar Intercept Officer is important to understand where the contacts are located around the aircraft, especially in certain phases of the engagement, such as when approaching the merge or the "visual range" and when scanning for ground targets.
This ability, if properly used, allows:

1. quicker and more precise correlation between the radar or the LANTIRN pod and the world outside. Decreases the risk of "tunnel vision" and the sense of disorientation when raising the head from the TID and DDD;
2. increases the SA as, for example, smoke plumes can be visually spot in the expected direction of the target, reducing the reaction times;
3. In case the radar lock is broken, the RIO can padlock the target and talk the pilot through.

Peculiar features of the cockpit can be associated to specific angles, both in terms of altitude and azimuth. However, this references may be vastly affected by variables such as the height of the seat, the zoom level (the more you zoom out, the greater the fisheye distortion).

3.4.1 ***ELEVATION

The altitude reference is the most subject to imprecision due to the factors mentioned above. Figure 83 shows the elevation difference using references ~1.5nm from the F-14.

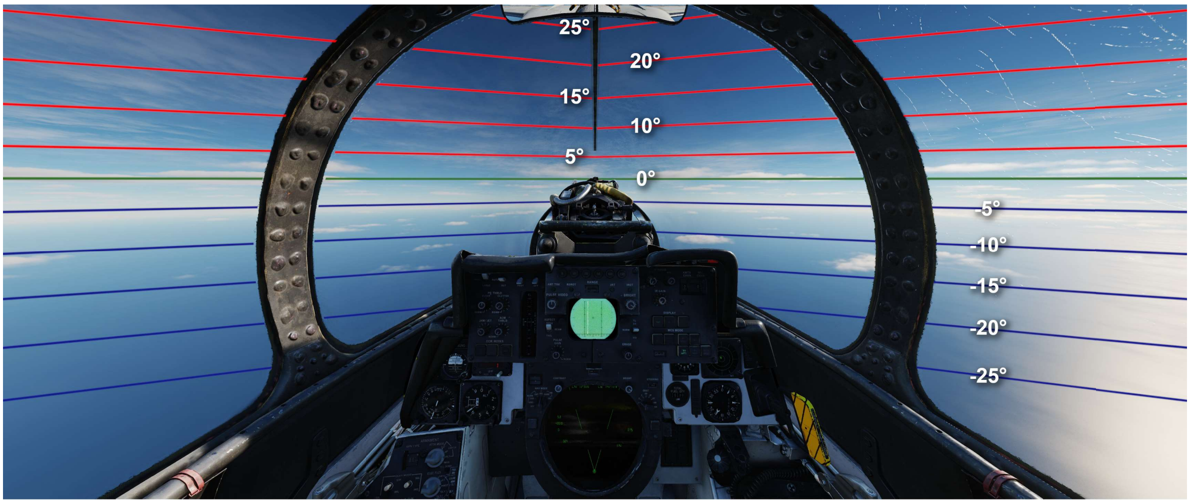

Figure 83: Visual references - Elevation.

This paragraph is on hold until [this question is answered by the devs](#).

3.4.2 AZIMUTH

The azimuth references, in Figure 84, are more reliable as the cockpit is warped along with the outside world when zooming in and out. Besides, it should less (or not) affect VR players.

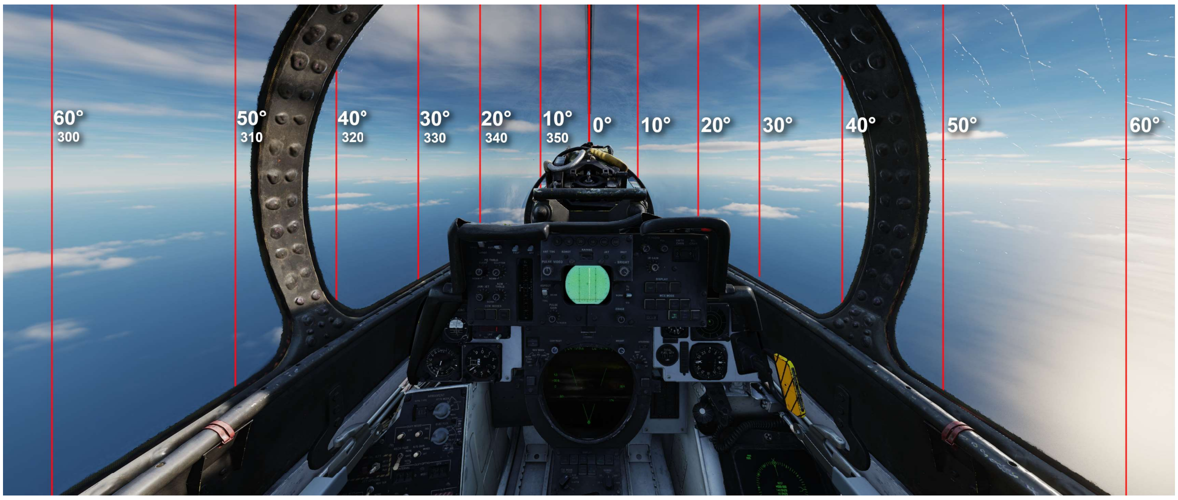

Figure 84: Visual references - Azimuth.