



# Fly by Wire

The unique F-104G CCV-Starfighter in 1/48

By Michael Ullmann

**T**he German air force purchased more than 900 F-104 Starfighters, but one was unique. This Starfighter, designated the CCV, captured my imagination a long time ago. In 1993 I visited the museum in Koblenz to take measurements and photographs of the original aircraft, intending to build the model. Now more than twenty years later Hasegawa have provided their own conversion kit in a limited edition of their superb F-104 Starfighter kit in 1/48.

The development of this famous aircraft mirrored a very interesting period in aviation history. It was a time when scientists were developing the idea that an unstable aircraft had superior flight characteristics compared to a conventional stable design. FBW - Fly by Wire - were the magic words then and nearly every nation with a significant aerospace industry developed their own FBW test aircraft, for example the US with their X-29 and the UK with their FBW Jaguar. The CCV (Configuration Controlled Aircraft) Starfighter was the German contribution to this technological development, results of which contributed to the design and function of the Tornado and much more significantly, of the Eurofighter.

The project started in December 1974 when the

German Ministry of Defence contracted MBB (Messerschmitt-Bölkow-Blohm in the early 1990s merged with other German Aerospace companies into the DASA, today as CASSIDIAN, part of the EADS group) to undertake the design and test of an FBW system. For the test airframe MBB received F-104 G 23+91. The contract was divided into two



## F-104G Starfighter CCV

Kit No: 09961 (Limited Edition)

Scale 1/48

Type: Injection Moulded Plastic

Manufacturer: Hasegawa

### Also Used:

Eduard #49036, F-104 G GQ-7 Seatbelts

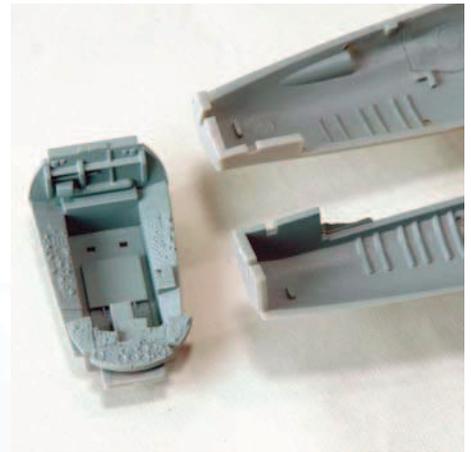
Eduard, #EX031, F-104 Mask.

PaintsXtracolor: X251 RAL 6014 Gelboliv

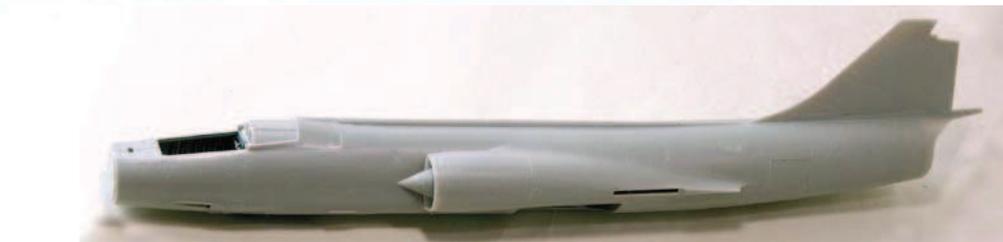
Xtracolor: X252 RAL 9006 Weissaluminium

Xtracolor: X254 RAL 7012 Basaltgrau

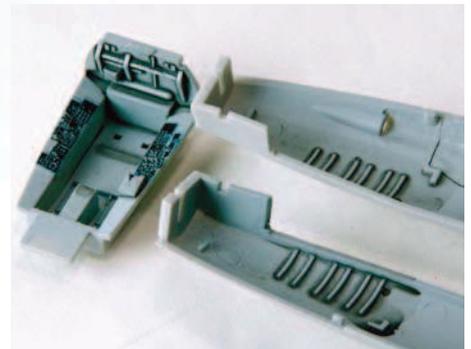




The cockpit area and the tub primed in light grey, which is the basic colour for German Starfighters



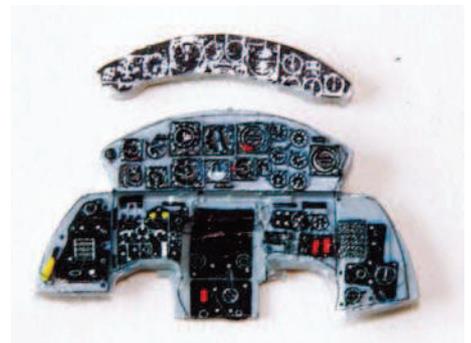
Assembling the fuselage according to the instructions. So far unmodified, the parts are now ready for conversion to the CCV-Starfighter configuration



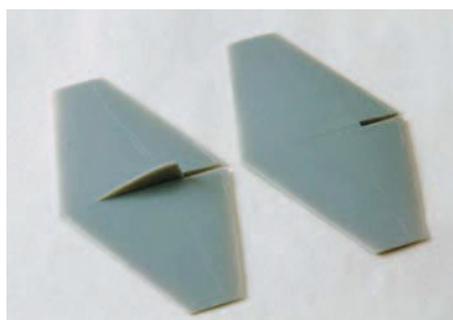
The cockpit area and tub after a dark wash and application of the decals. It is not really necessary to replace the kit parts with aftermarket, because they are very well detailed



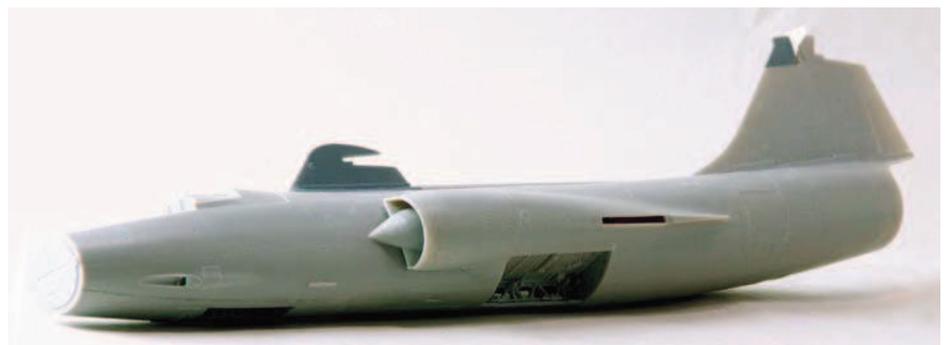
The cuts have been made to fit the conversion parts



The modified instrument panel. Visible is the additional panel mounted over the main part. The restricted view this will have given in the already small cockpit of an F-104 can be imagined. I modified the main panel by removing the center RADR-Equipment and replaced it with another CCV-specific panel accordingly to the original cockpit photos



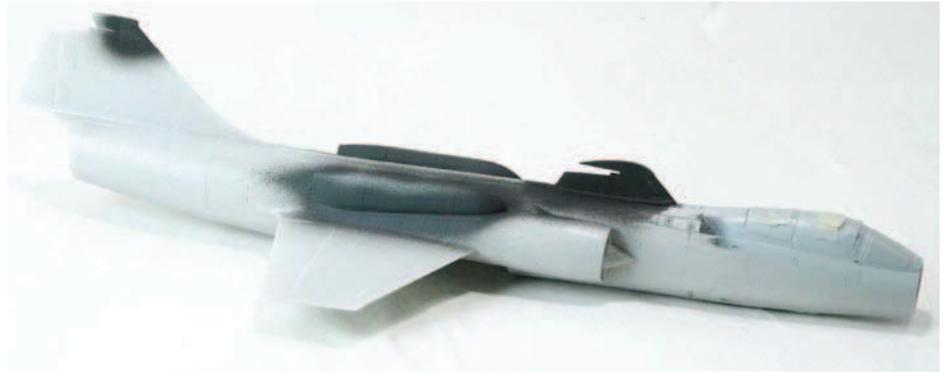
The kit provides two stabilizers. The left one shows the original configuration. The right one is modified



The kit's superb resin conversion parts are clearly visible because of their darker grey resin. I used cyanoacrylate glue for gluing the parts



Attachment of the additional part above the main instrument panel. Visible is the black paint sprayed to locate any imperfections on the surface. Some cleaning up needs to be done on the area aft of the cockpit where cutting has been undertaken



More parts attached to the fuselage. Again black paint was used to show any imperfections on the model's surface



A big step forward. The model received its paint job - the typical German Air Force camouflage from this period. I used my favorite brand, Xtracolor, for this. The high gloss finish is a big advantage for decaling



Parts of the kit primed in white to get a perfect surface for the Day-Glow orange colour. These markings were also a typical Luftwaffe feature at that time to enhance visibility for low level flying

phases. Phase I (1974 – 1977), development, construction and test of the FBW system, included twenty test flights. Phase II (1977 – 1984) was the 'hot' phase, which saw the aircraft tested in five different configurations:

- B1 = Basic, full self-stable
- B2 = Basic, with 600 kg tail ballast
- E1 = Ente (Canard) configuration, stable with 240 kg nose ballast, manual flying characteristics
- E2 = remove of nose ballast, 400 kg tail ballast, only with FBW system flyable conditions.
- E3 = E2 with additional 200 kg tail ballast, highly unstable, only with FBW.

This phase included intensive flight tests of the FBW system in the airframe. 117 test flights were conducted during the phase, and after the contract's end the aircraft was not destroyed but was sent to the museum in Koblenz, and can be visited there today.



Hasegawa have blessed us with their own conversion kit. The resin parts are nicely moulded without any flash and minimal casting blocks, which makes this conversion a perfect one for beginners. The instructions offer three different marking schemes with all decals, one option showing the original call sign 23+91. The other two have the test aircraft call sign 98+36.

I built the kit straight from the box, according to the instructions. The only changes I made were in the cockpit, where I modified the instrument panel using my own cockpit photos and added the superb Eduard pre-painted seat belts for the ejection seat.

As usual I started with the cockpit and sprayed this area in accordance with my reference photos with a bright grey, using the kit decals for the side panels. After a dark wash you are left with a nice replica of the test aircraft's interior, but please keep in mind that test aircraft were always maintained in mint condition, therefore weathering is not appropriate in this area. Very soon the cockpit and the rest of the necessary parts were installed into the fuselage. Using my preferred liquid glue technique there was no need for any filler and the fuselage required a minimum amount of sanding.

Next it was time to modify the fuselage as outlined in the instructions. There are only a few quick and easy cuts needed to modify the fuselage and the fit of the resin parts was excellent. For the stabi-

lizer on the canard configuration the kit contains a second regular stabilizer that requires a little modification.

I modified the instrument panel according to the reference photos, and for this I used a second, spare instrument panel and a modified kit decal. I

also modified the instrument panel's shroud, and to replicate the fabric-covered appearance of the original I covered the panel with a section of paper towel then painted diluted clear lacquer over it. When dry I trimmed the paper towel to fit.



The aircraft next received the Day-Glow markings.



The model now received its coat of silver paint on the undersides



After application of a dark wash. Bear in mind that German aircraft during this period were perfectly maintained and kept in good condition. Be careful not to over-weather the model

To check the fit I painted all modified areas of the fuselage, including the joints with the resin parts, with black paint. When dry this showed all imperfection on the surface, and after removing these I was able to paint again for 'quality control'. I also masked up the transparencies with Eduard masks and painted the frames in the same grey as the cockpit interior.

The upper surface of the model was painted in the two camouflage colours, RAL 7012 (Basaltgrau) and RAL 6014 (Gelboliv). It was a pleasure to see the high gloss achieved with my preferred brand, Xtracolor. This left the surface perfect for decals, without silvering, and it was also ideal for my preferred technique of weathering. The Day-Glo parts of the model were painted first in gloss white. This is essential as a primer, because the hi-viz paint covers poorly. For this I also used a gloss paint. The underside is painted in RAL 9006 (Weissaluminium)

The model was given a careful wash with artists' inks. The advantage of this is that they are water

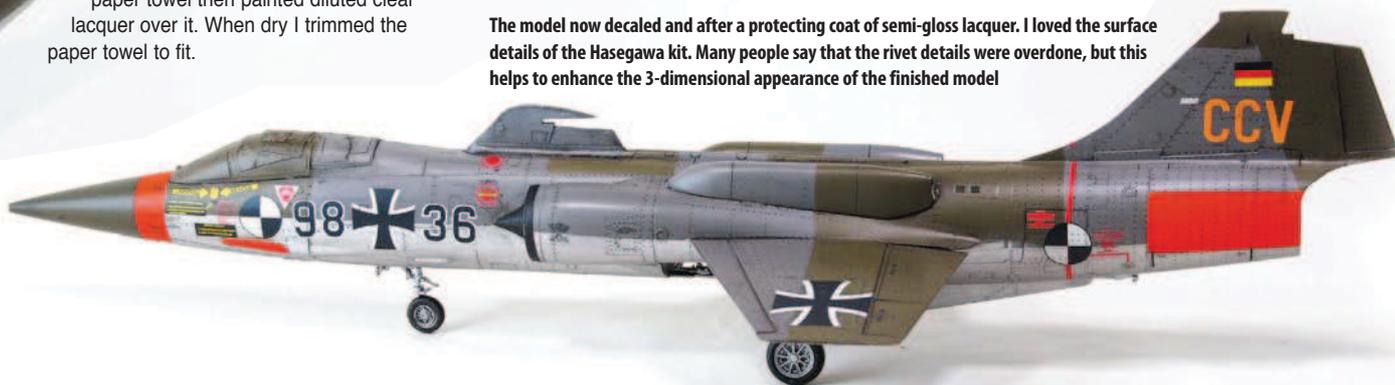
soluble and, when dry, water resistant. When the ink was dry I polished the surface, which just left black in the very fine panel lines. You can also create subtle effects when you polish the ink off in the direction of the airflow.

All decals were sealed with satin lacquer, masks were removed from the clear parts and final details were added to complete the model. **MA**

#### References (German language):

- F-104G als Versuchsträger – CCV für künstliche Stabilität
- FlugRevue 6/1982
- Die Ente mit dem Bleiballast – Eine Reportage über die CCV-104
- Flugzeug 6/87
- Im Westen nichts Neues?
- Modell Fan 10/87

The model now decaled and after a protecting coat of semi-gloss lacquer. I loved the surface details of the Hasegawa kit. Many people say that the rivet details were overdone, but this helps to enhance the 3-dimensional appearance of the finished model





98+36 during its testing times. Hasegawa have done well to kit this unique and important airframe (Archiv P.Sedlak)



A starboard view of the aircraft being readied for a test flight (Archiv P.Sedlak)

The strange symmetry between the forward canard and the tail are apparent in this head-on view of 98+36 at the height of its test career Archiv P.Sedlak)





The aircraft now resides in the military engineering museum in Koblenz, where due focus has been placed upon its historic role, as evidenced by the clear panels in the tail (Michael Ullmann)

The aircraft at rest during its test programme. 98+36 carries the standard Luftwaffe camouflage and markings of the period



Note the orange paint surrounding the cannon ports and the usual plethora of stencilling typical of the era (Michael Ullmann)





# Testing Times

The unique F-104G CVV-Starfighter in pictures  
Original material from the Luftwaffe's WTD-61  
(Via Michael Ullmann)

On 20 November 1980 the experimental aircraft F-104G CVV took off from Manching on its first flight in the E-1 configuration, with the prominent destabilizing canard wing mounted behind the cockpit

**F**ly-by-wire, now an established facet of aeronautical engineering, is essentially a system replacing conventional manual flight controls with an electronic interface. The movements of flight controls are converted to electronic signals transmitted by wires (hence the fly-by-wire term), and flight control computers determine how to move the actuators at each control surface to provide the ordered response. Fly-by-wire control systems also allow aircraft computers to perform tasks without pilot input and afford flight characteristics that would be unobtainable in a regular manually-controlled aircraft.

The F-104G CVV was one of the early testbeds for FBW, and we are grateful to the Wehrtechnische Dienststelle 61 for the opportunity to publish these unique images of the aircraft during its fascinating career. **MA**



The unmistakable silhouette of 98+36 creeps through the haze as it taxis prior to a test flight



Here the aircraft is seen wearing its original codes, 23+91 – an option offered on the Hasegawa kit decal sheet



Although the mounting of the canard wings considerably changed the aircraft's aerodynamic performance, the CCV flight control system ensured stable flight characteristics



An early view of the aircraft prior to its receiving the 98+XX code typical of German test aircraft



98+36 in seemingly stable flight. The programme was completed in 1984 after 176 test flights



The CCV program was a major milestone in the conception and development of the Eurofighter



A rear view of what some regard as the most significant testbed aircraft in the Luftwaffe's postwar history



The F-104G CVV shows off its less-than-uncluttered lines – a missile with a man in it, yes, but with a tea tray bolted on top!



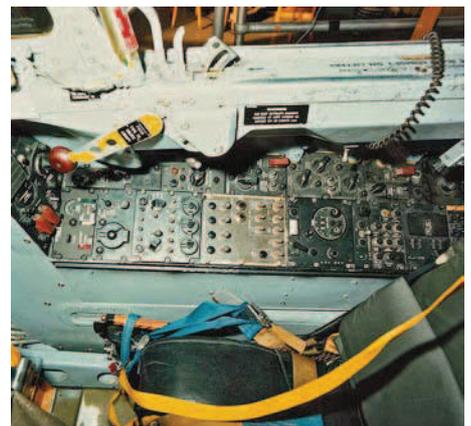
The aircraft touches down at Manching at the conclusion of another test flight



The aircraft's cockpit showing additional instrumentation unique to the F-104G CVV



The already restricted view was further impeded by the additional instruments at the top of the main panel



A closer look at the starboard side console