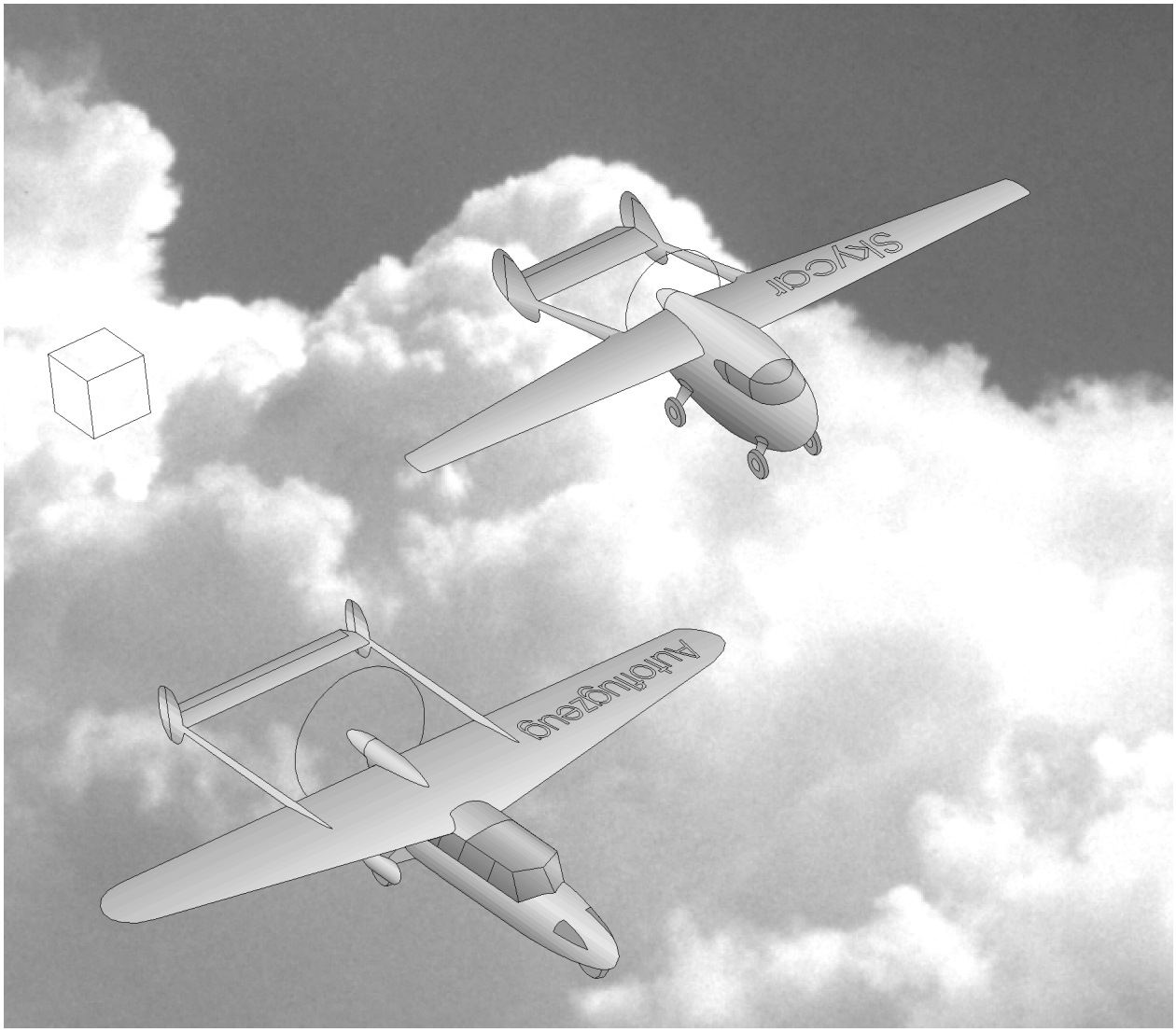
Other aircraft with low nose without propeller: the convertible plane-cars. "Flying cars" are detailed further (page 71) but here we present roadable aircraft. With external wing-panels removed or folded, they had a very short wing, and drove with the push of their airscrew, framed by booms and tail as safety guard (a nose propeller, awfully dangerous for pedestrians, was obviously excluded). This kind of machine was imperfect in streets but much simpler than a flying model with driving wheels.

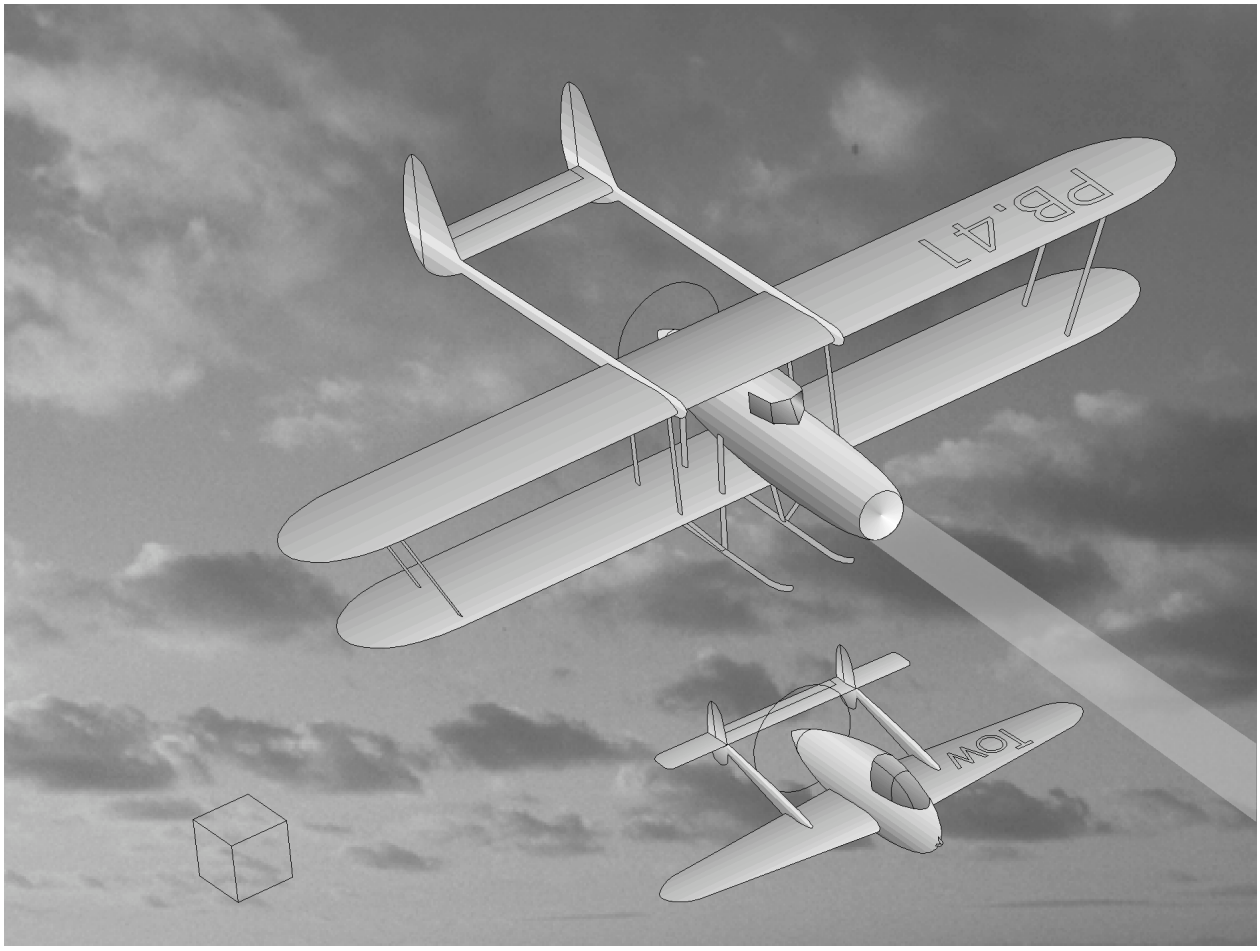
In the years 1939-45, this class seems illustrated by the **Dornier Autoflugzeug**, designed by the Dornier Aircraft company, or the imaginary Kotuba/Flying Airsedan.

Concerning the **Stout XC-65 Skycar**, or its derivative UC-107 Skycar III, the status of plane-car is not sure. It could explain the use of close booms (width acceptable on road) and inclined downwards (to protect pedestrians), while the nickname is not completely convincing: the concept "car of the sky" was often used to indicate simple planes as practical as road vehicles (Gwinn AirCar, Spencer AirCar, Kaiser-Hammond Aircar, Portsmouth Aerocar, Benett/Waitomo/Transavia Airtruk, De Kellis-Holson AirTruck, Partenavia Tapete Air Truck, Fairchild Skytruck, etc).



Instead of a lateral door for passengers, it would have been possible to choose a cargo door in the nose – with an elevated cockpit. The free nose can be used for different purposes, like a radar. In the early 1940s, more original devices were considered:

- A hook for towing was featured on the project **Pemberton-Billing Tow-Fighter**. It was tugged on long distances as a glider, before starting its engine then being detached. After the required loops and rushes, it was coming back to the mother-ship, re-engaging its nose at the end of the cable, then shutting down the engine, to become a glider again. The economy on tank volume and weight made it possible to reach a top speed and agility. Even if this was a convertible airplane/glider, there is no relation with the modern motorized-sailplanes (e.g. twin-boom Kora 1, Avispa, Stratos 500) that take off without assistance before shutting down the engine for the main flight goal: free sailing. The Tow-Fighter was rather related to the planerlets, like the twin-boom Antonov LEM-2, which were towed planes taking off with assistance then continuing by themselves only. Concerning the principle of reversible fixing to a large transport aircraft, this recalls the rigid systems of Sparrowhawk, Zveno, Goblin, FiCon, etc.
- Another original use of the nose: the installation of a large projector, on the **Pemberton-Billing PB.41**. With a nose propeller, two smaller projectors would have been used, lateral, with a convergence difficulty for the light rays, towards only one spot only instead of a long linear way. Exclusively a night plane, the biplane PB.41 was a carrier aircraft, installed on top of a classical plane that was unable to take off by itself, blind and overloaded (like a Hurricane with huge extra tanks). The convergence concern was major at that time, but most of all that was not for peaceful light rays...

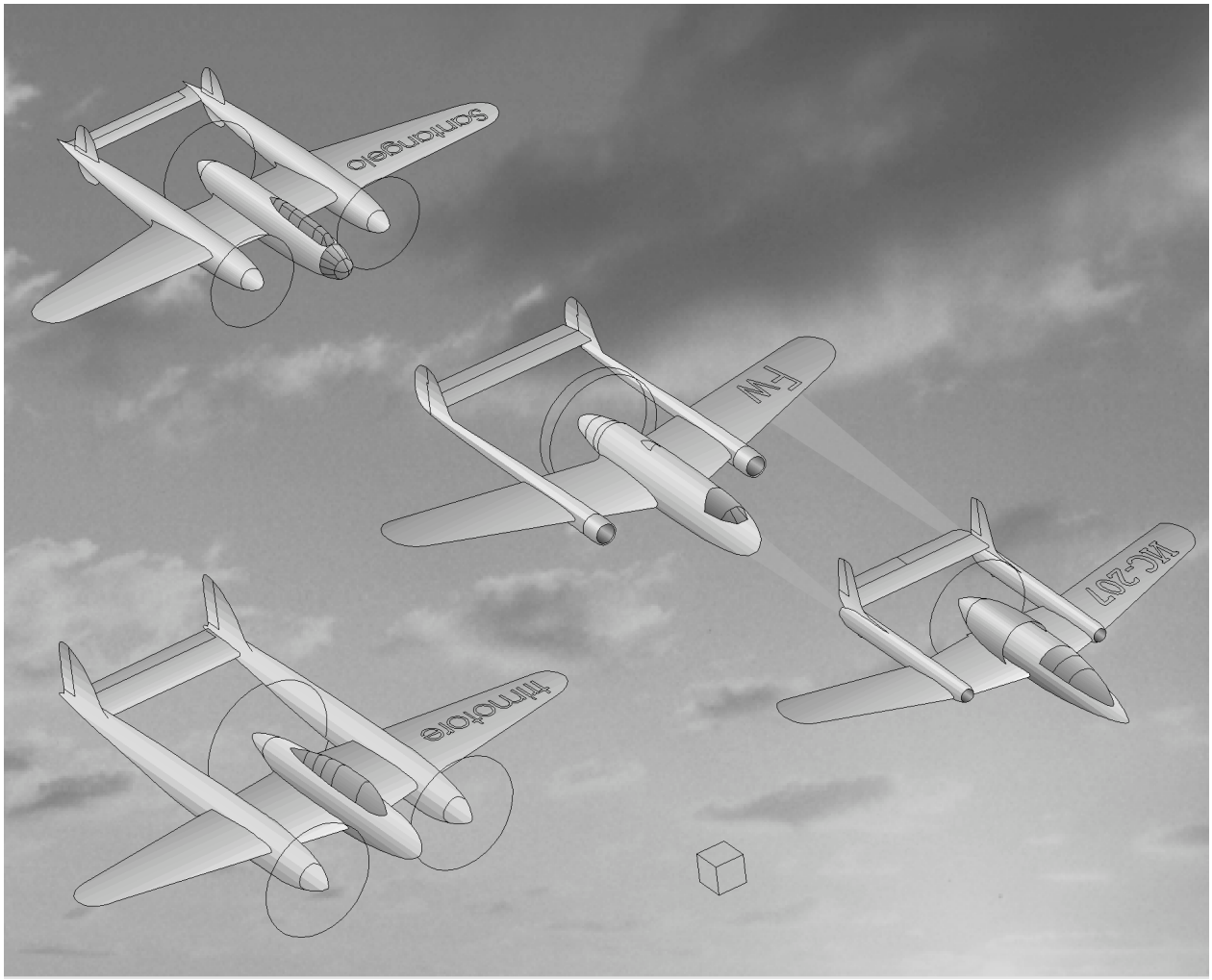


3.4.3 - Synthesis

Previously, we have focused on advantages one by one, while of course several may add to one another on a single airplane. Mainly, the aerodynamic advantage related to the absence of frontal vortex can be associated to any use of the free nose.

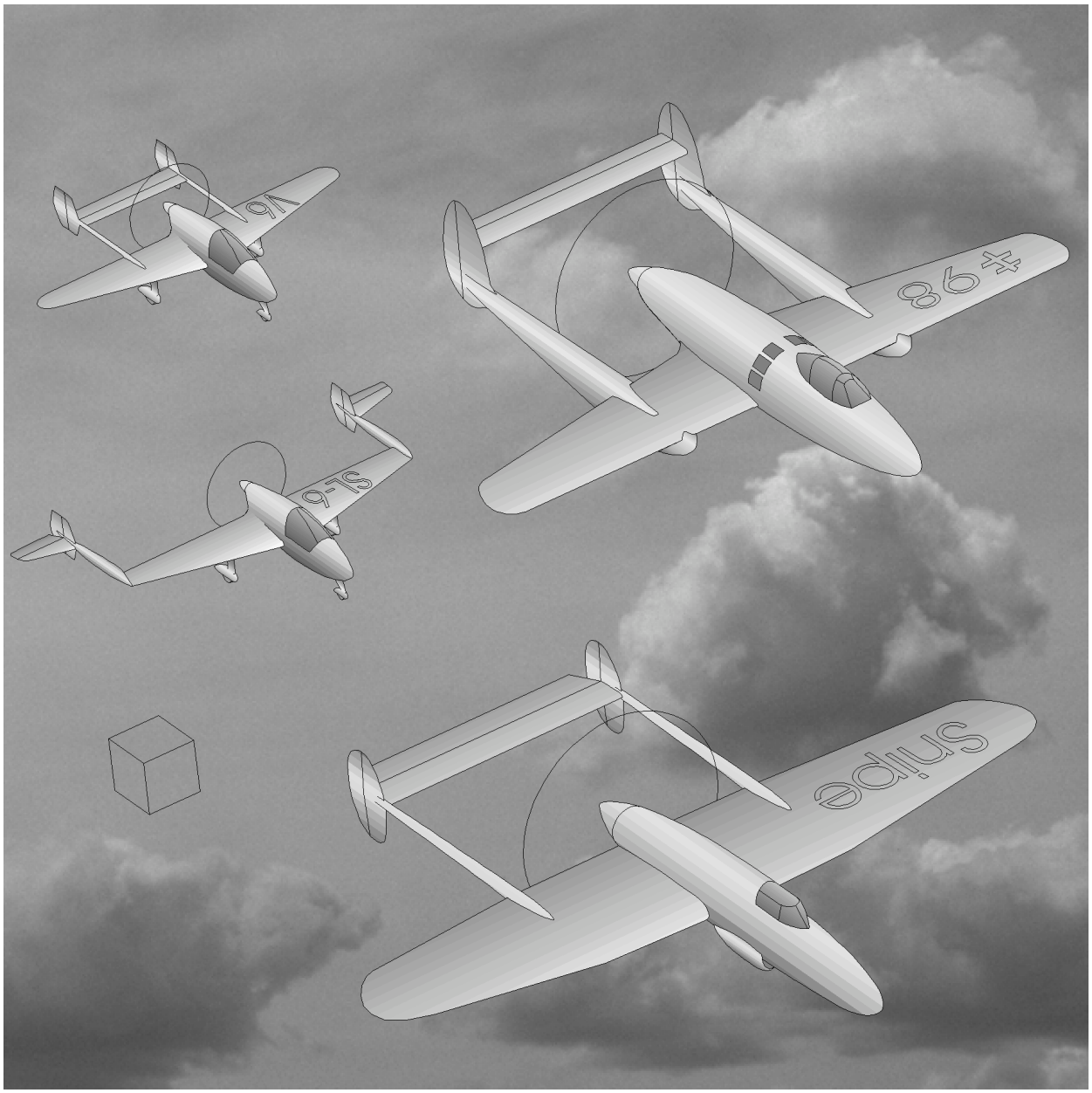
Before the main common list, a few special items will be presented, with booms not limited to circumvent the propeller for tail support:

- The **Borovkov-Florov IS-207** (or model D) used two ramjets and a piston engine. All the aerodynamic advantages of the rear propeller were welcome to reach the speed at which the ramjets could operate. Secondarily, these tubes were prolonged to carry the tail without separate booms. This solution evokes the hollow beams of the Tupolyev ANT-23, and the turbojet-booms of the Centre NC-1072.
- A project **Savoia-Marchetti trimotore** and the **Santangelo Combattimento** employed the same principle as the Borovkov-Florov: the nose is free thanks to an axial rear engine and the lateral engine pods are lengthened to carry the tail. This kind of three-engined non axial push-pull had been very popular among old twin-boomers: Caproni Ca.1 and derivatives, Air Department Type 1, Graham-White E.IV, Siemens-Schuckert L I, Ungarische Lloyd 40.08, Beardmore WB.VIII, Schütte-Lanz G VI, SIMB AB-3M, Biche JB.3, etc.
- A version of the **Focke-Wulf** project without name, mentioned in chapter 3.4.1 (pages 66-67), also employed such a configuration, but with an opposite principle: the engineers used the lateral booms to place radiators in front of them, without adding frontal area and the nose remained free.



Associating agility, aerodynamics, free nose, twin-boomers had many advantages, and lots of projects came from different designers. The **Snipe** was one of these, even if it was perhaps designed before 1939 and revealed lately. The **Mansyu Ki 98** was more modern, with its bubble canopy and its faired dorsal air intake; its bulky booms contained the retracted landing gear, allowing the use of a very thin wing, for high speeds.

The small **Skoda-Kauba V6** and **SL-6** were test-beds for the rear propeller. Built together with tractor propeller models, they would have given useful comparisons, and those experimental results could have been extrapolated to high-speed planes, then jet planes.

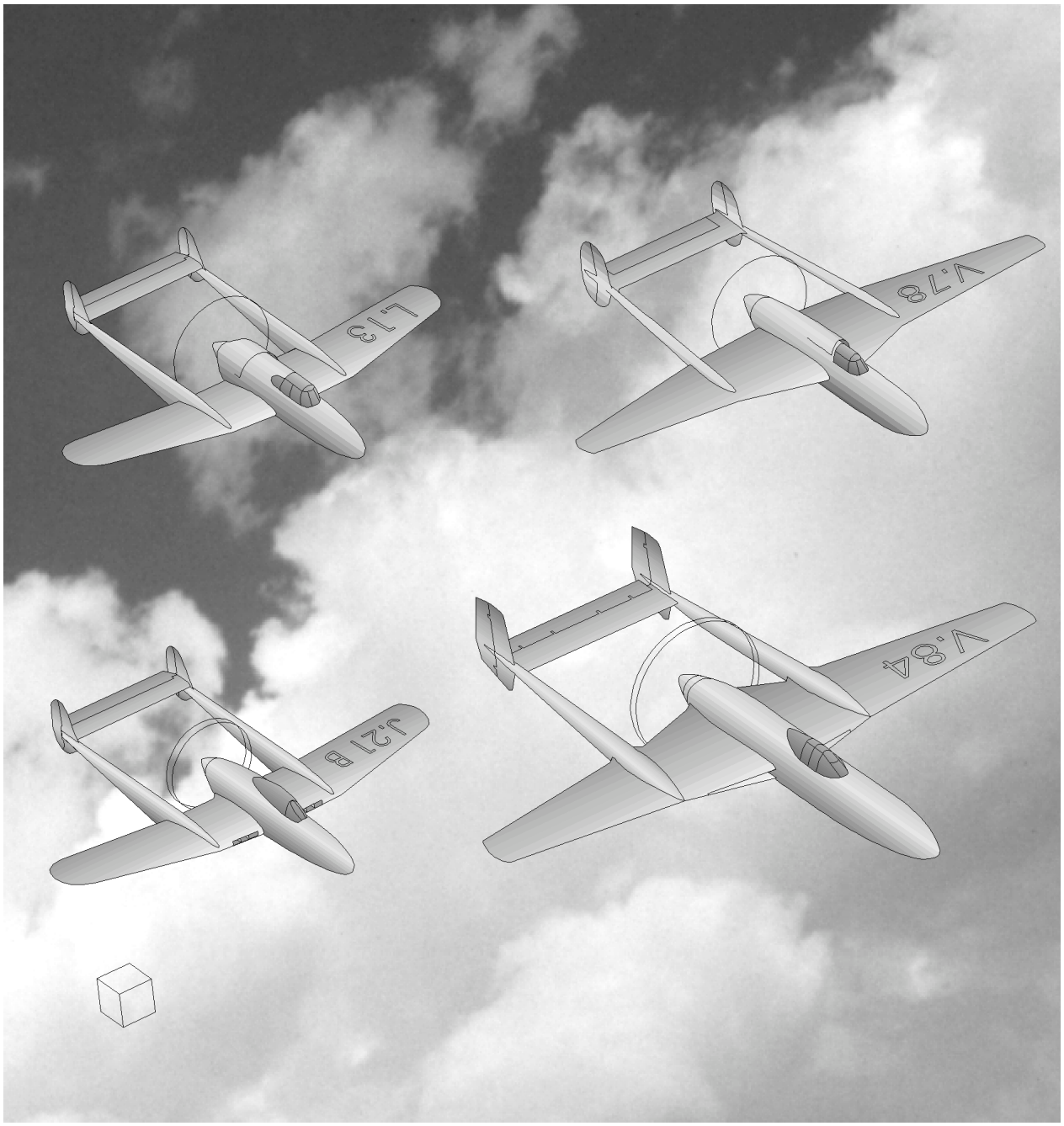


With a single fin, the **Boulton-Paul P.99** was designed together with a non twin-boom version, the canard P.100. Even with brilliant performances, this was almost heresy…

Other single-fin twin-boomers with rear propeller were the **Brewster Proposal P.33A** and its derivatives: P.33 B to E. This model had an arrester hook below the tail, for very short landing. Curiously, the first version, A, had the largest engine, contradicting the general tendency to power endless increase. In fact, the first intention was using a huge engine, but the risk of its cancellation leaded to less ambitious solutions. A modernized version appeared later: **P.33 Revision II**, with a laminar wing, a bubble canopy, contra-rotating propellers.

One of the most successful rear propeller twin-boomers has been the mass-produced SAAB J 21A after 1945, but the original design had been considered in several cancelled versions before that. The **SAAB Linköping L.13**, progenitor of the L.21, should have used a radial engine, with a bigger pod and with air cooling. The **SAAB J 21B**, during the development of the J 21A, was planned to use contra-rotating propellers and a bubble canopy.

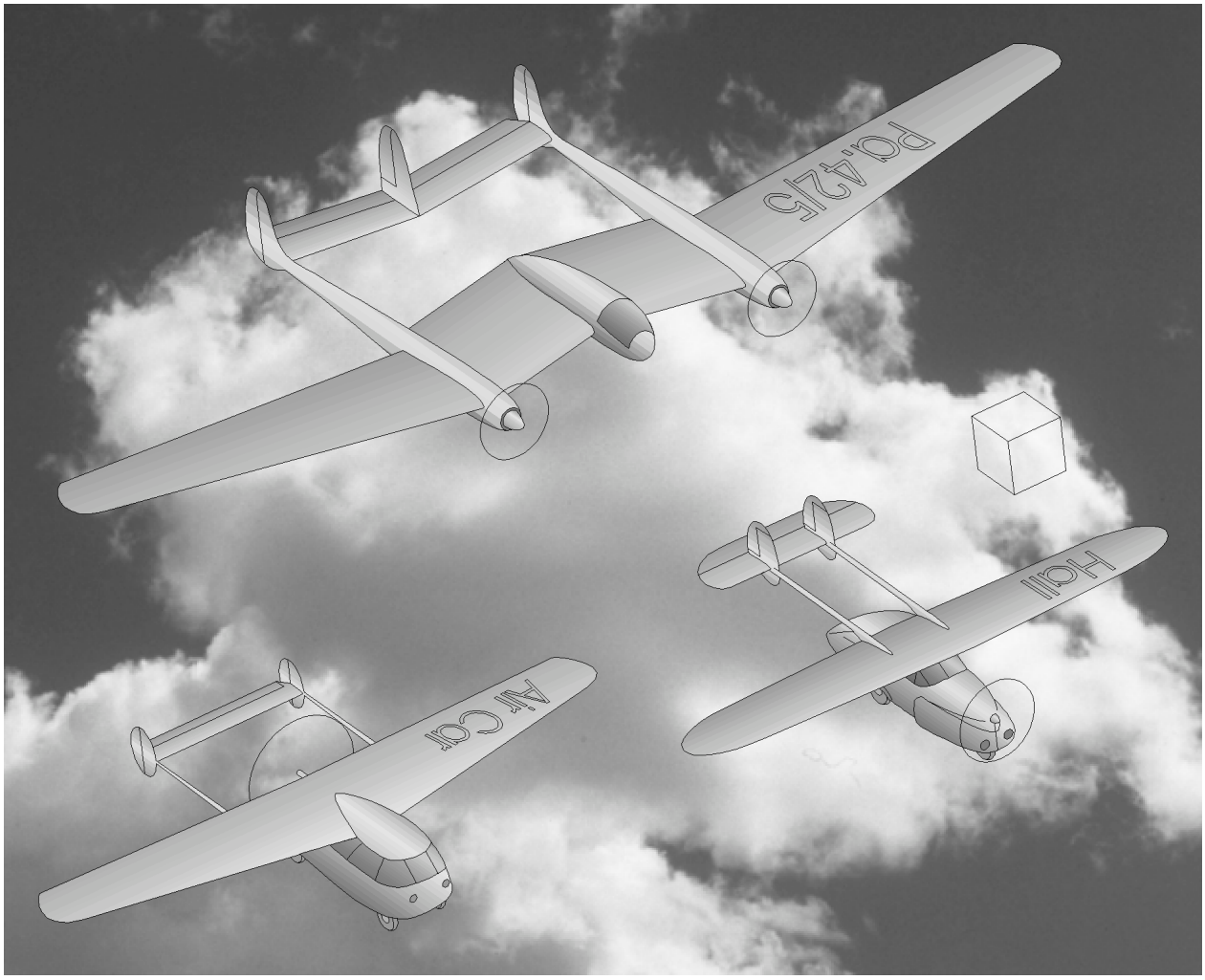
A similar evolution occurred in the Vultee family of twin-boomers: several versions were considered, with or without bubble canopy, contra-rotating propellers. All had a weird layout: convergent beams towards the rail, a wing with composite sweep and dihedral (W seen from above, W seen from front). The **Vultee V.78** marked the history of twin-boomers by being judged technically better than canard projects or flying wings featuring the same rear propeller. The **V.84** model, of increased size and with a swivelling nose, leaded to the famous prototype Consolidated-Vultee XP-54 Swoose Goose. The last step was the XP-68 Tornado with a radial engine, air-cooled, probably via a ventral scoop.



3.5 – Removable pod

Presenting twin-boomers with rear door (chapter 3.2), it was mentioned the possibility to change the pod to have simply different versions; this principle was a main reason to choose the twin-boom way for family of models with and without rear post for instance – as the Focke-Wulf 189 B/C/D; but this was not good only for manufacturers, it could also be useful for the user when the pod could be changed in minutes. Among such planes are the actual "flying cars": more or less normal cars that were hang under an airplane wing (and engine, quite often). The modern AVE Mizar, employing as basis a mass-produced car and the wing-booms-tail of a Cessna Skymaster, reached a top in this family of twin-boomers – with perhaps the jet model in a James Bond movie. But between 1939 and 1945, such projects were already designed. The **Consolidated-Vultee Air-Car** had a twin-boom version, but the best example was the **Hall Flying Car**, which led to the Southern Flying Automobile after 1945 and to a Convair project. Interesting detail: during takeoff, acceleration was brought at the same time by the air-screw and the driving wheels, which is original for an airplane.

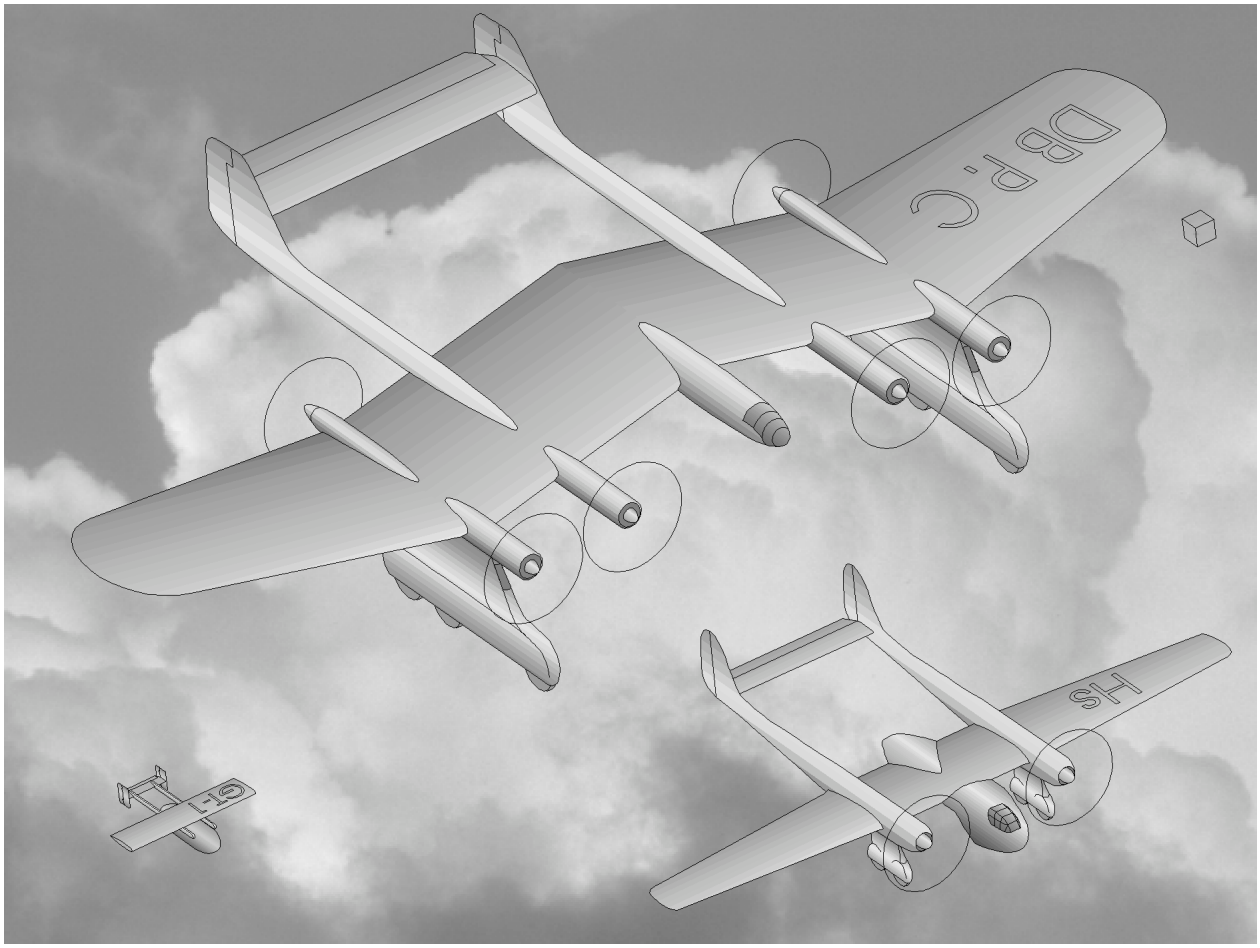
Similarly, the **Payen Pa.42/5** would have been a flying bus or truck, the removable part including the road driver cabin and a long compartment for freight or passengers. However, in this case, the plane could fly without the removable nacelle, the "air" cockpit being located on the wing itself. This plane would have been a weird three-engine: two side propellers would have ensured the propulsion in flight, while the third engine would have operated on the ground only, driving two wheels. This extra engine would have been a useless dead load in flight, but ensured great simplicity without commutable engine(s) having to drive very different devices.



From the Pa.42/5 principle, the ground-engine and road-driving post can be removed, for the detachable pod to be towed simply by a traditional truck, or be deposited on a truck platform if it does not have wheels. This principle became famous after 1945 with the Fairchild XC-120 Pack Plane, derived from the C-82. This way had been considered at the beginning of the 1930s on the twin-boom Grokhovskiy and Bernard/SPCA; later, it was used on many twin-boom projects (from Republic, Mc Donnell Douglas, Myasishchyev, Molniya, TsAGI, etc). Only helicopters like the Sikorsky Skycrane and Mil 10 succeeded in popularizing such principle of container-holder, their slow speed allowing the use of square cubes without any streamlining. In the period 1939-45, the family of twin-boomers with removable load was incarnated by a project called **Henschel Transport Flugzeug**. There was also the version with partially detachable pod of the Renard illustrated page 48.

While a nacelle can be removed *on the ground*, it can also be jettisoned *in flight*. The best examples may be the projects Payen K38 or Avro 721: a twin-fuselage transports a traditional airplane under its belly, and releases it after take off, the helped plane needing far less fuel and power. At the beginning of the 1940s, this principle was used in the project **Daimler-Benz Projekt C** (or Projekt B, sources disagree). The twin-boom configuration introduced a central hole for the fin of the lower plane, with no need for it to have a butterfly tail nor a tail-less layout. The Pemberton-Billing PB.41, presented page 66, employed the same principle.

The **Aeronca GT-1** and its derivative GT-8 are more original. They were small radio-controlled pilot-less gliders with releasable nacelle. The versions GB-1 to GB-8 are more difficult to classify: without any flight release, these gliders were twin-boomers with interchangeable nacelle like the Fw 189, but the *users* could select the right nacelle just before the flight.



3.6 – Simple pod

On many twin-boomers with central pod, the median axis did not have any notable characteristic, and the explanation of the twin-tail layout was elsewhere.

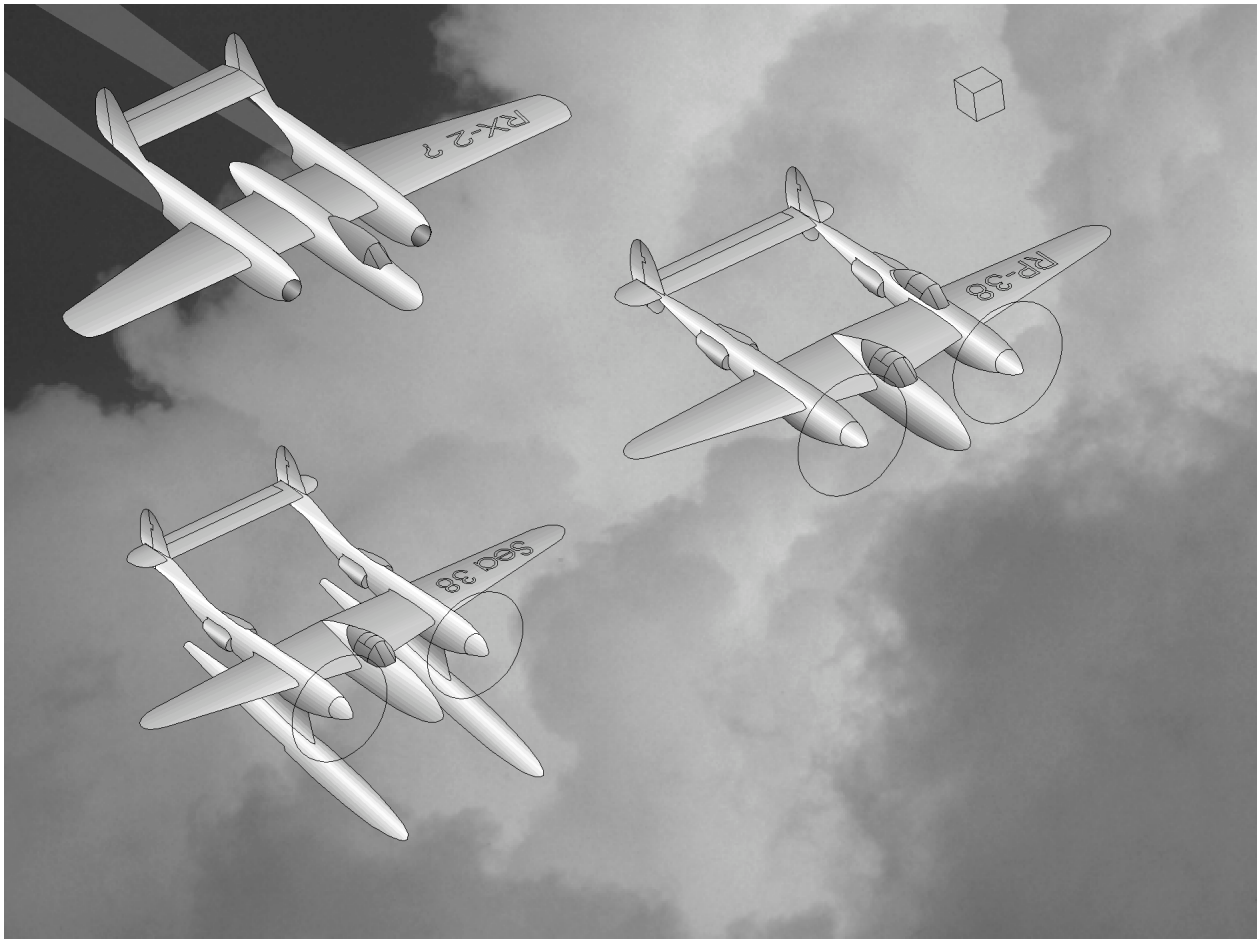
3.6.1 – Lateral weights

Long lateral engine pods may carry the tail, without lengthening the central pod. Some twin-jet aircraft preceding the Centre NC-1072 could have been this way: an author who described the jet **SAAB RX-2** as looking more like a Black Widow than like a Vampire probably referred to this principle.

With piston engines, there was the still unknown **Sud-Ouest E-1910**, progenitor of the SO-1070. Here, the goal was a minimal length for size handling on carriers; the solution was big fins behind the engines, holding a large tailplane (its big size was compensating the short distance from the center of gravity).

Other examples: the last versions of the famous Lockheed P-38 Lightning family. The basic Lockheed 22, before 1939, got its twin-boom formula from the cumbersome turbocompressors and radiators which lengthened its engine-pods. Among the late and cancelled derivatives, 1939-45, were the XP-49, the Swordfish, or the **RP-38** hybrid of standard model and asymmetrical derivative, the seaplane version (**sea-P-38**?).

Before closing this paragraph, let us mention that the principle of lateral weights was involved in many other models: seen previously were inhabited booms (XCG-9), load-compartments in booms (Bv P.196), motorized booms (Borovkov-Florov). Moreover, booms often included landing-gears or lights etc., their utility being not only to support the tail.



3.6.2 - Derivatives

After choosing the twin-boom layout for a good reason, a model can see this reason disappear on its derivatives keeping the same layout. The most famous is the Lockheed P-322 which was a Lightning without turbocompressor, therefore with short engine pods far ahead of the tail. The same phenomenon can be illustrated with the projects of Lightning with radial engines: the L-24.0001 was before 1939, but the most powerful **Lockheed L-106** with R-2160 engines was contemporary of the last P-38 versions.

The **Savoia-Marchetti SM.88** and **SM.91** seem to have been derivatives of the three-engined project with rear propeller seen page 67. Deleting a pusher propeller on push-pull with lateral propellers was not new: the old Graham-White E.9 Ganymede and Breda Italia had been twin-engine derivatives of such 3-engined twin-boomers (G.W. E.IV and Caproni Ca.5).

On the basis of a single-engined aircraft, the same amputation led to a glider, what was done for the final variant of TsAGI LS.

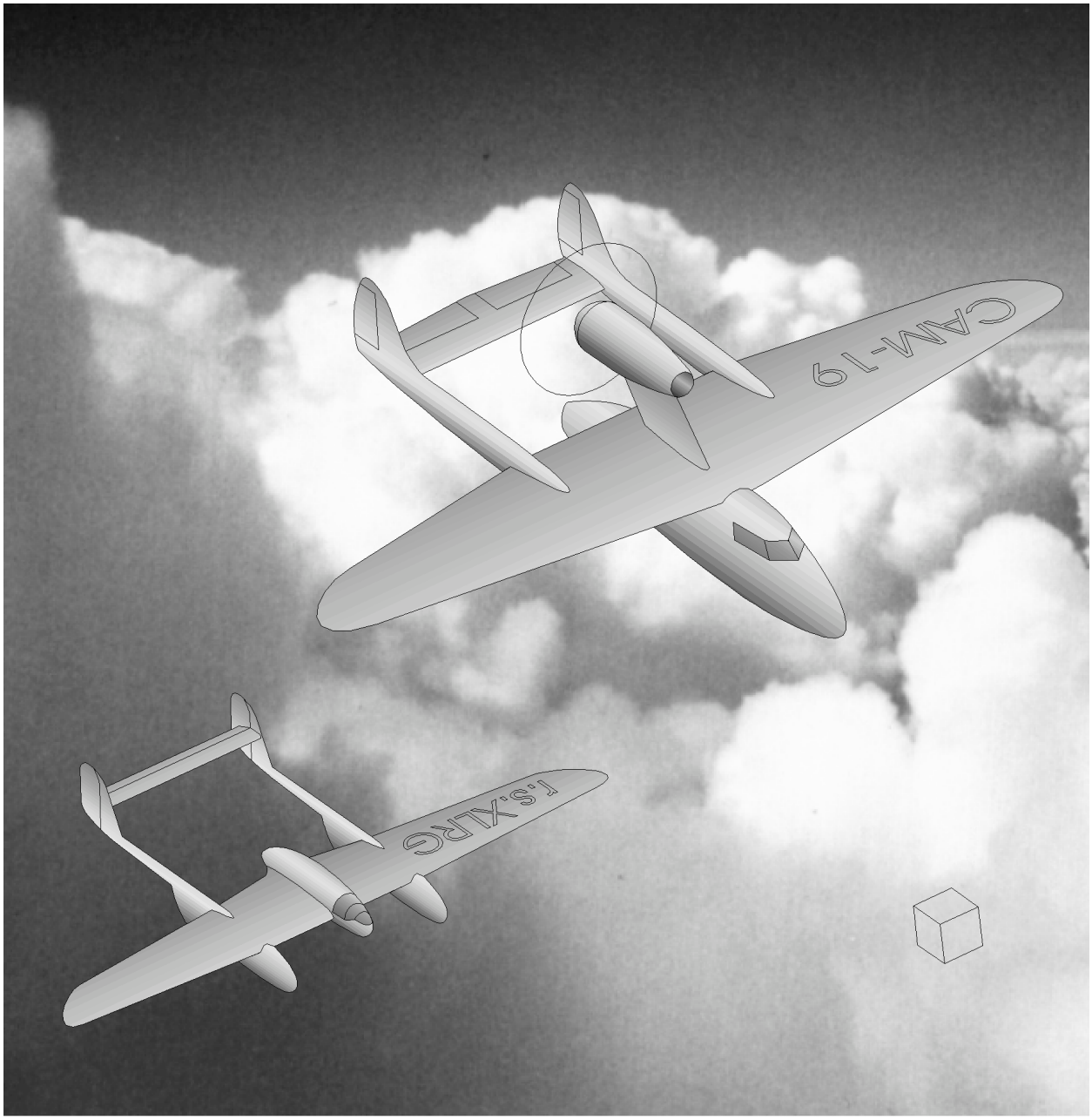
Removing a rear post can drive also out of the "comprehensibly twin-boom" class. This way, the P-61B and D-2 became **Northrop XP-61E** and **Hughes D-5**, themselves being progenitors of the Northrop XF-15 Reporter and Hughes XF-11 projects, finally built after 1945.

These airplanes could have been designed in a traditional form, non twin-boom. For the XP-61E, the only advantage was to use available parts from the mass-produced P-61. For the D-5, the explanation is not clear: it could be a question of prestige, Howard Hughes having sworn to do better than Lockheed's P-38 for a high-speed twin-engine twin-boomer, and wishing perhaps to 'prove' that his D-2 expensive failure had been useful.

Also without rear post, an experimental version of the XLRG-1 (**AGA reduced scale XLRG**) had booms that were neither cabins nor floats – just to validate the structural choices of the main project.

The Moskalyev SAM-19 is more difficult to interpret. It could be the derivative of a seaplane: the starting point would have been a kind of Aerocar Coot B, with a short hull optimized for hydrodynamics with no need to support the tail – then transformed into a land-plane, the initial twin-boom layout would have remained, for minimum changes.

This closes our review of twin-boom projects designed in 1939-45. For the readers not having found in these pages all that they sought, the appendices will present borderline items and explain why some data were not included [see also the additional books and sites mentioned page 2].



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