

Early German Metal Aircraft 1900-1930

Scott Malaznik

SAWE San Fernando Valley Chapter

August 1, 2013

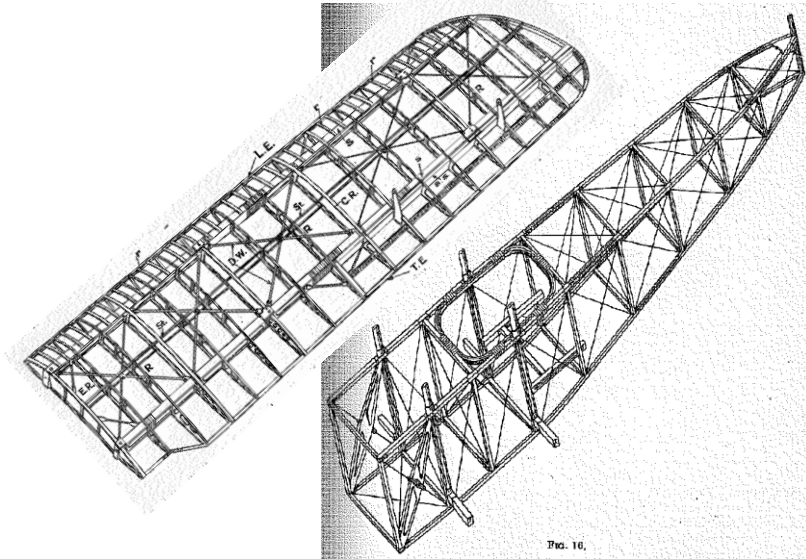
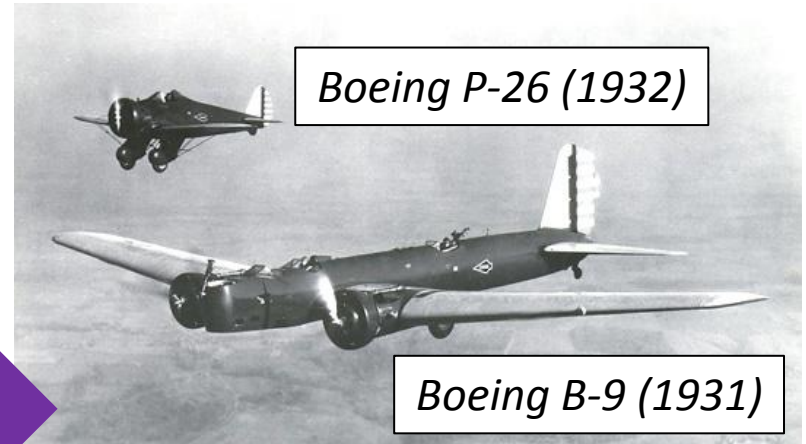
From Wood to Metal

Wood Framework
Wire Braced
Fabric Covered



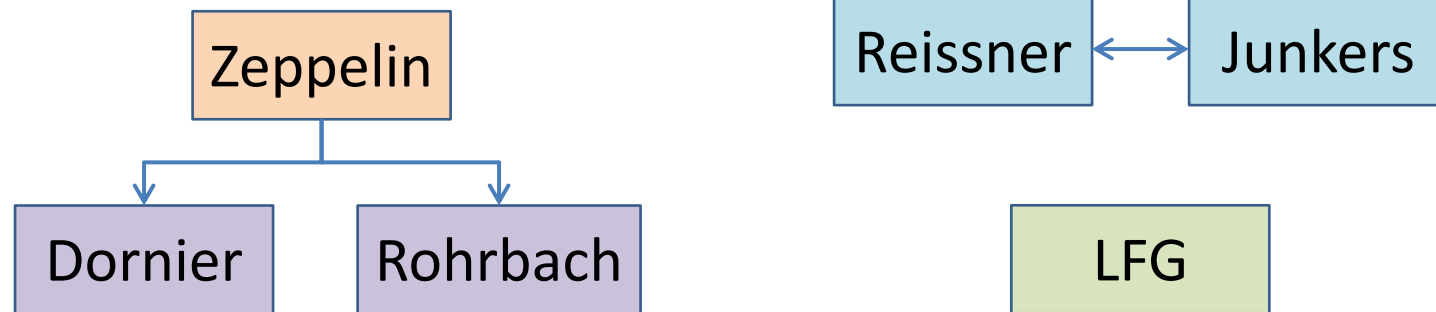
Transition

All-Metal (Aluminum)

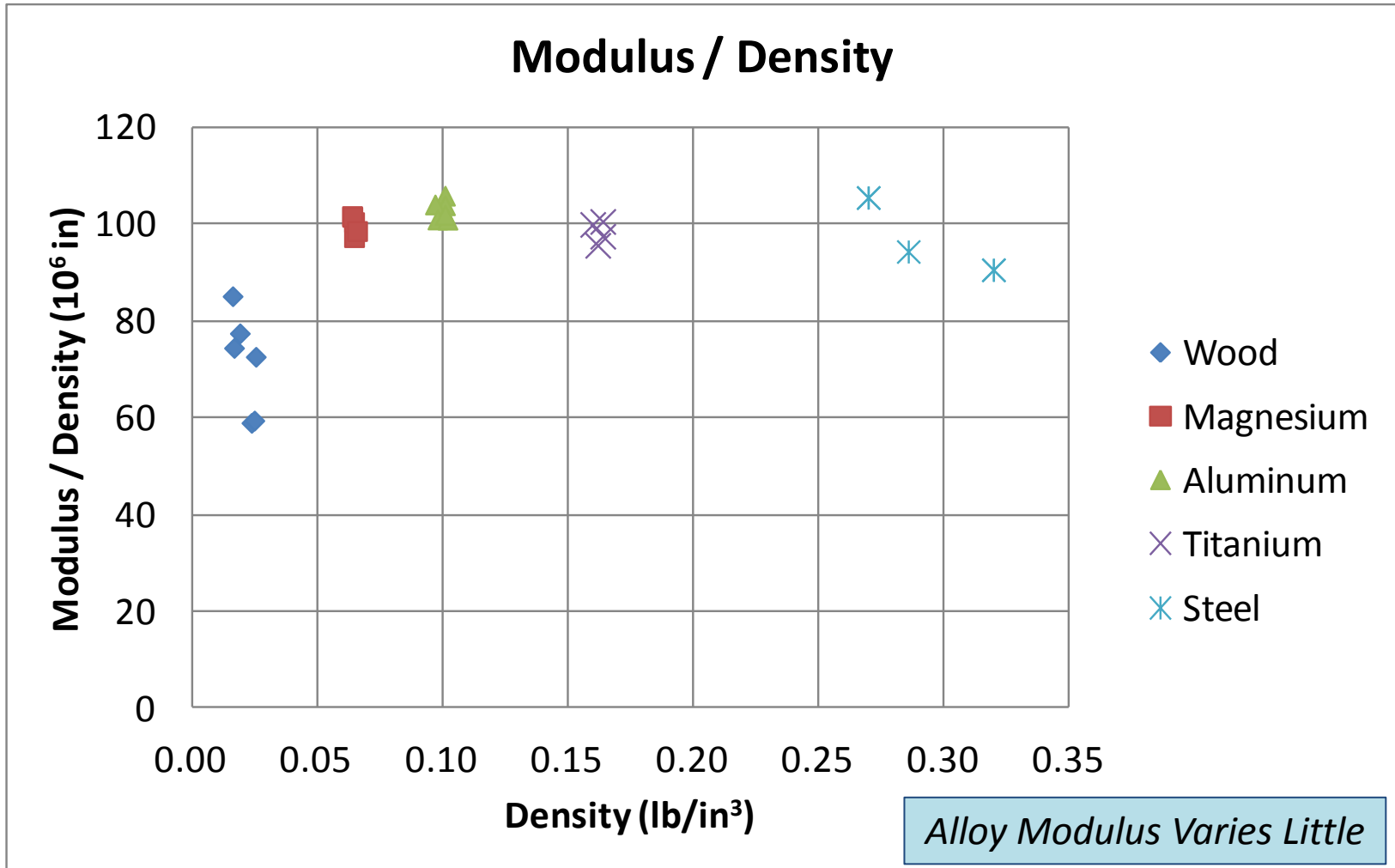


German Pioneers

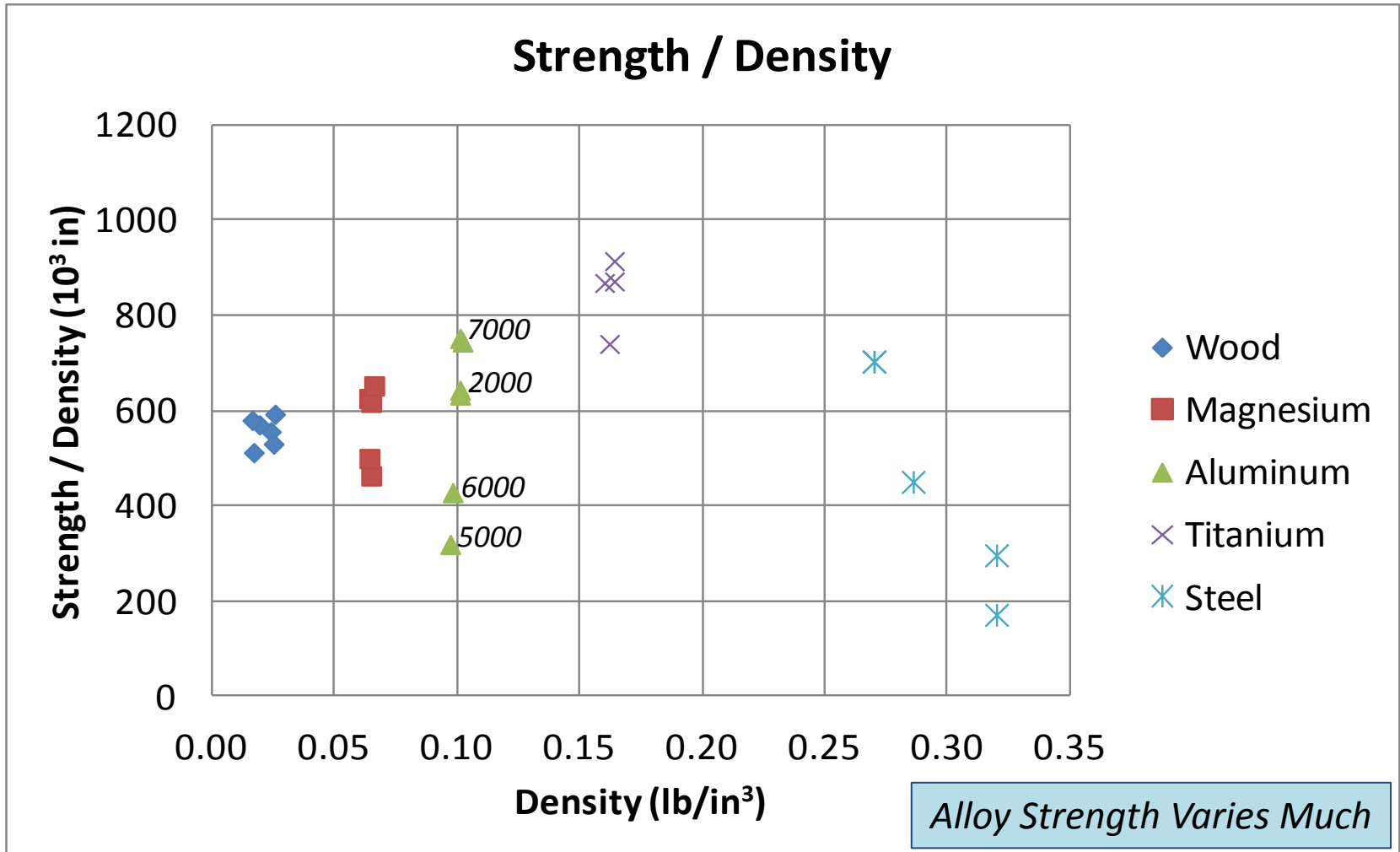
Several German engineers/firms were influential in this transition:



Material Stiffness Comparisons



Material Strength Comparisons



Power of Metal Alloying

Alfred Wilm discovered age-hardening of aluminum alloys

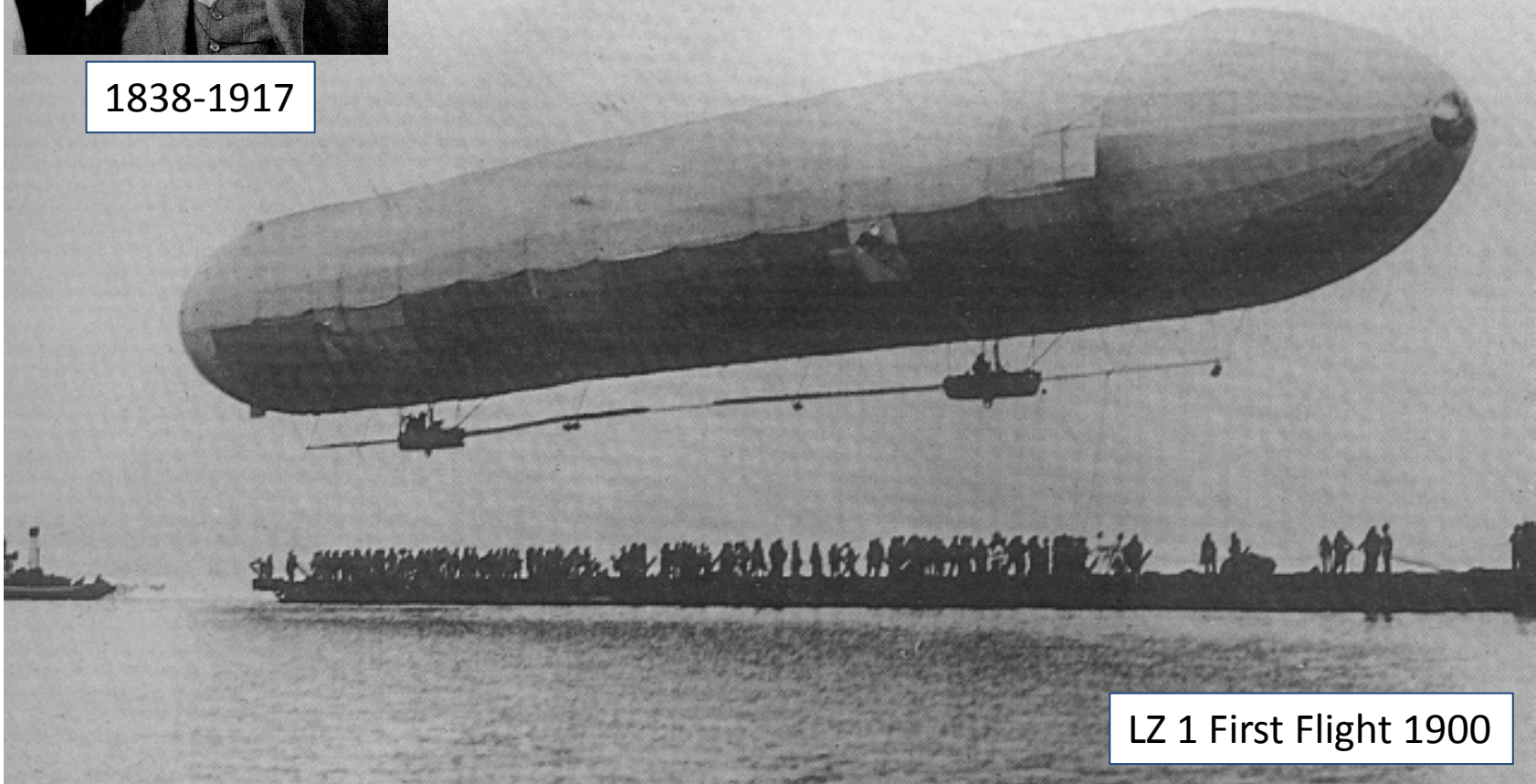
Aluminum Alloy	rho lb/in ³	E MSI	Ftu ksi	% increase in strength
Pure	0.098	9.9	13	
2024 (4% Copper)	0.101	10.5	64	392%
7075 (6% Zinc)	0.101	10.3	76	485%

Zeppelin "Rigid" Airship



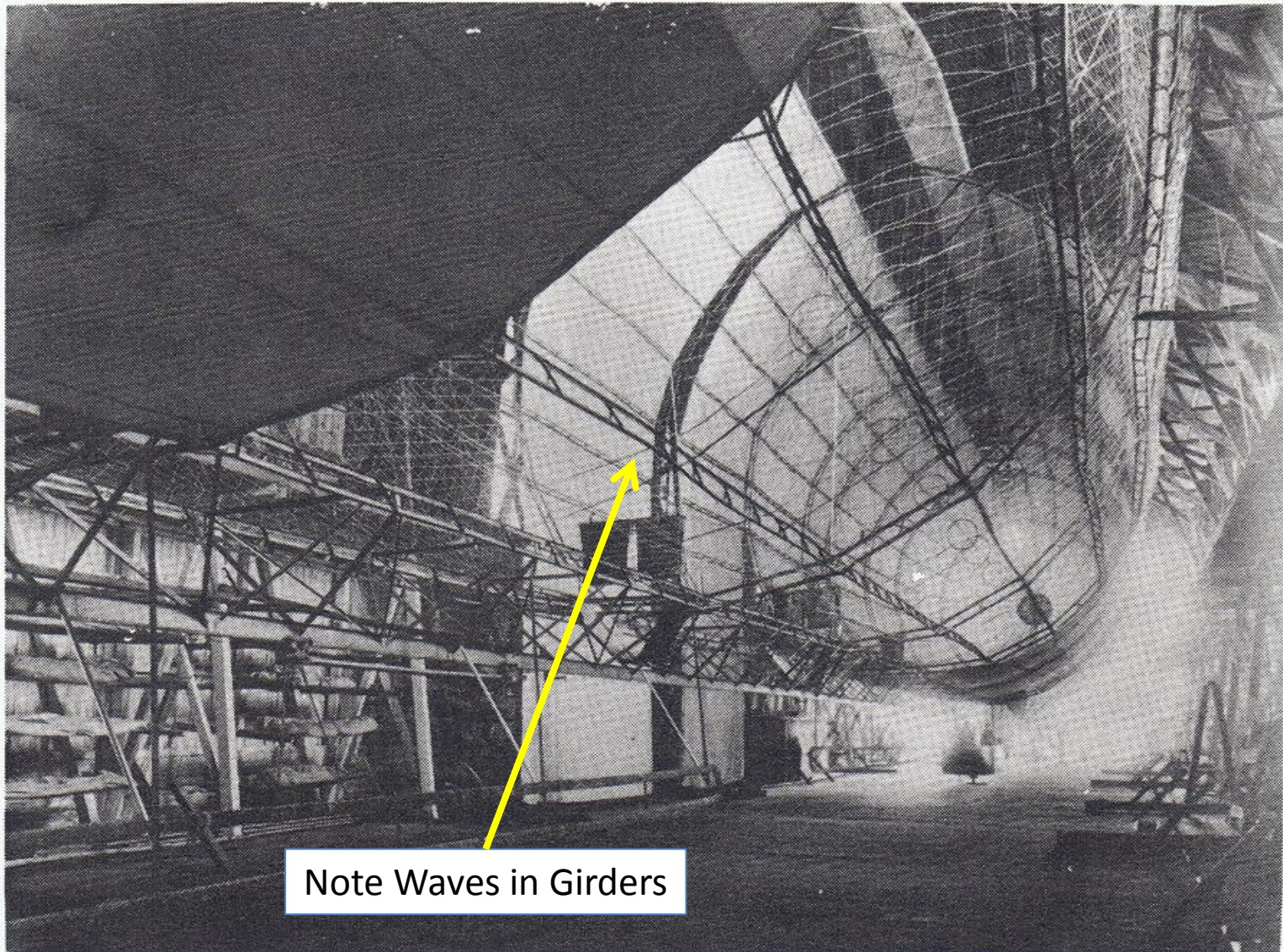
1838-1917

420' Long



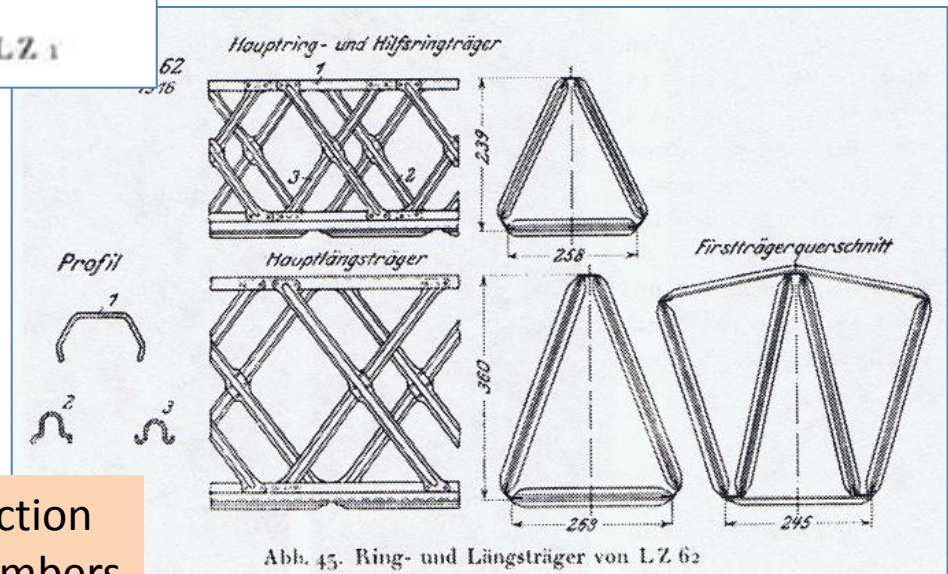
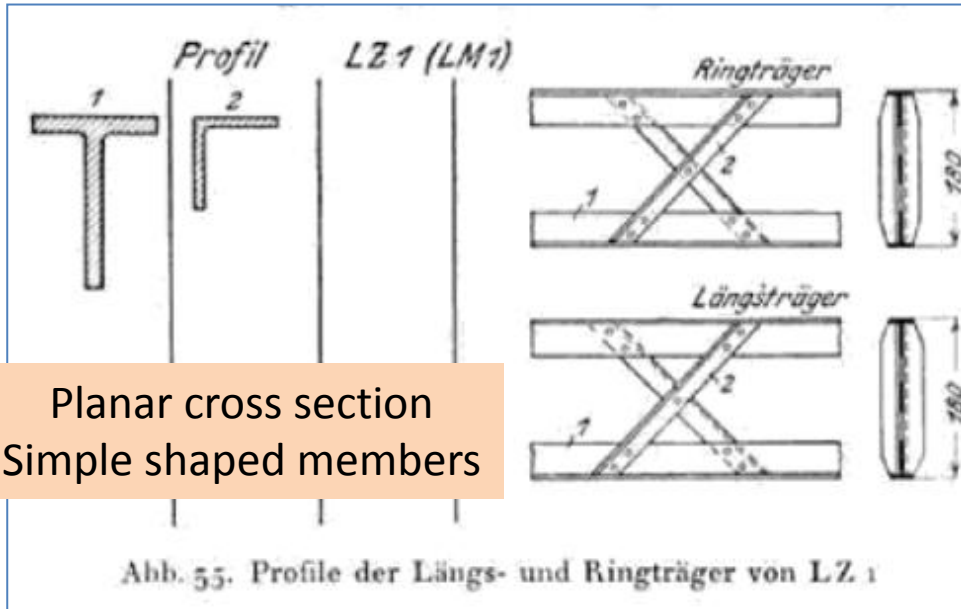
LZ 1 First Flight 1900

Not Very Rigid!

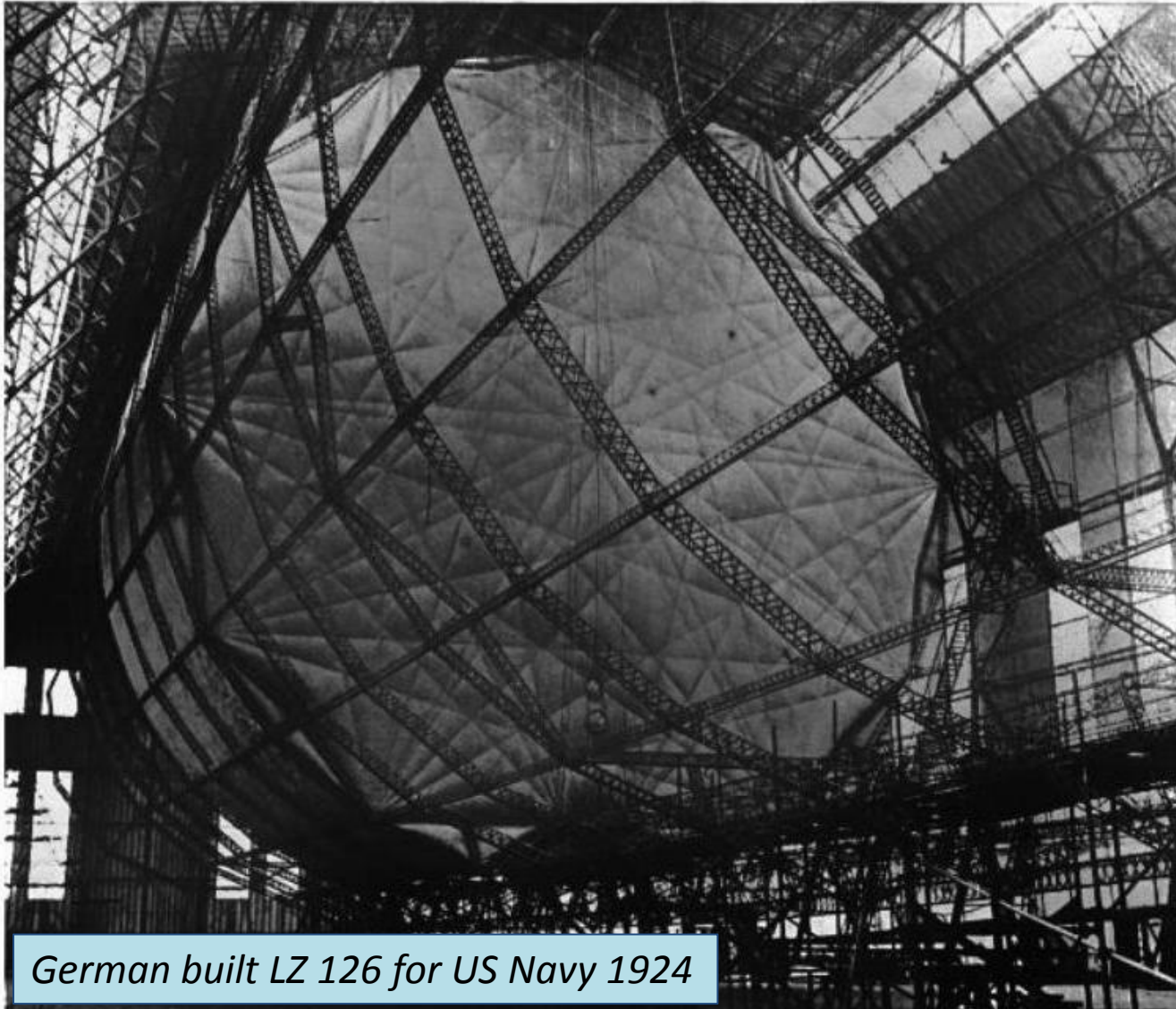


Note Waves in Girders

Zeppelin Girder Evolution

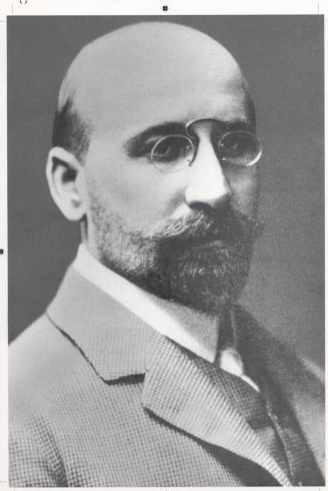


Looks Better!



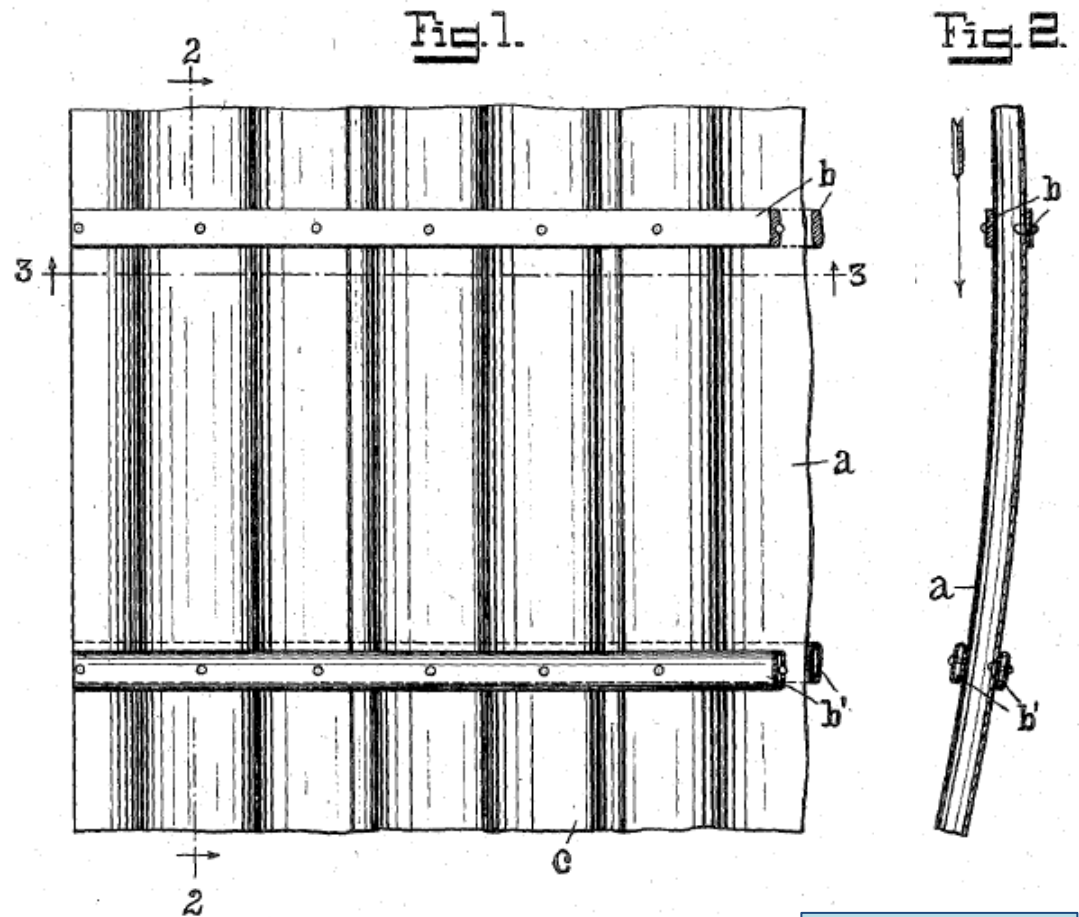
German built LZ 126 for US Navy 1924

Hans Reissner



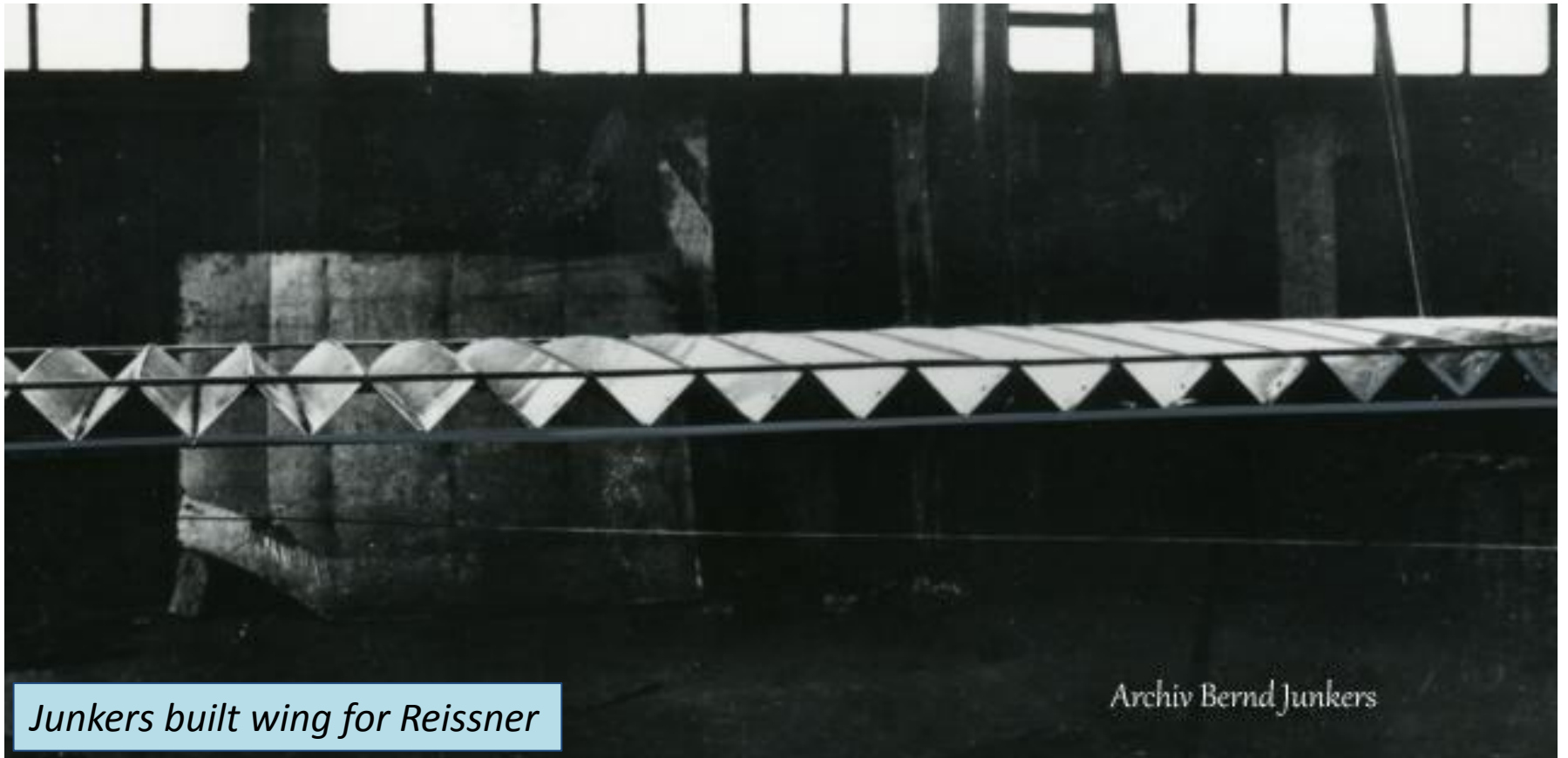
1874-1967

RWTHAACHEN
UNIVERSITY



1910 Patent

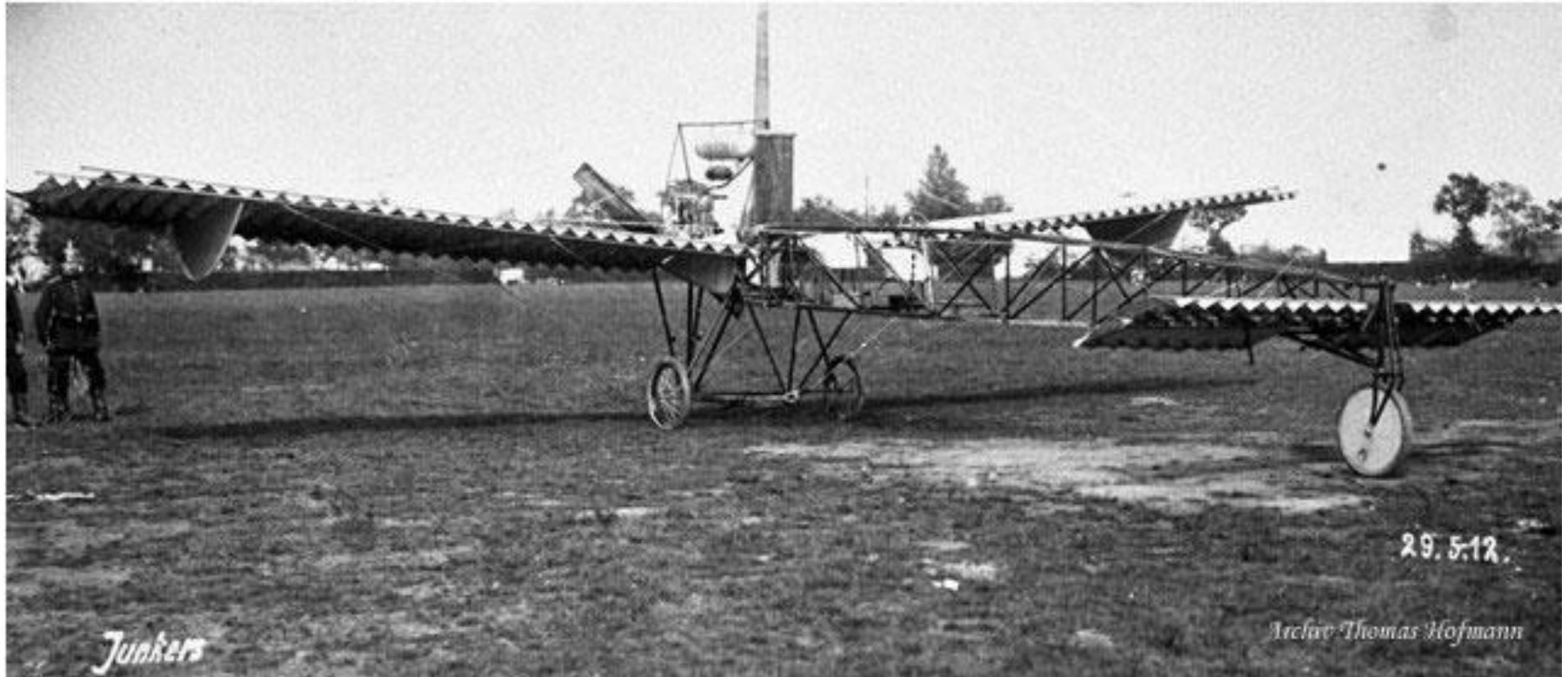
Corrugated Wing



Junkers built wing for Reissner

Archiv Bernd Junkers

Front View



Entenflugzeug

*German: Ente = Duck
French: Canard = Duck*

Rear View



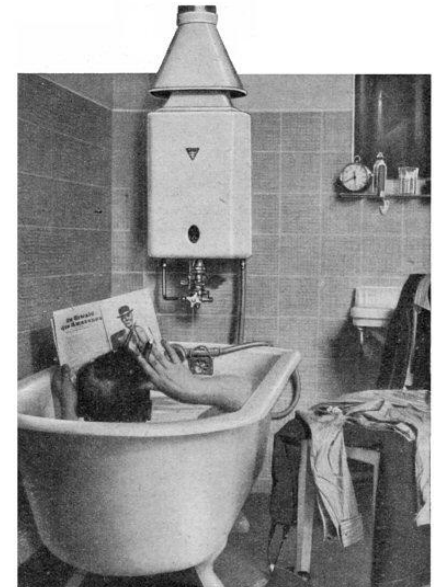
It Actually Flew!



Hugo Junkers



1859-1935



Ein

JUNKERS...

welch herrliche Gelegenheit, täglich warm zu baden und zu brausen, ein belebender Genuß für Körper und Geist. Wenn Sie das entbehren, stellt Sie ein Junkers-Gasbade-ofen bald zufrieden. Er ist durch Fachgeschäfte zu beziehen

JUNKERS & CO. G. M. B. H., DESSAU

Verlangen Sie kostenlos Druckschriften

1910 Patent

Often called a Flying Wing

Fig. 4.



Fig. 5.

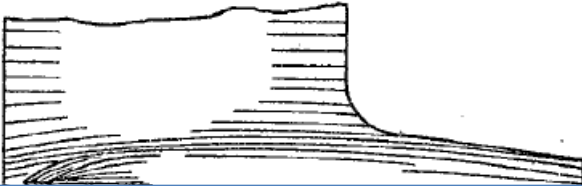


Fig. 2.

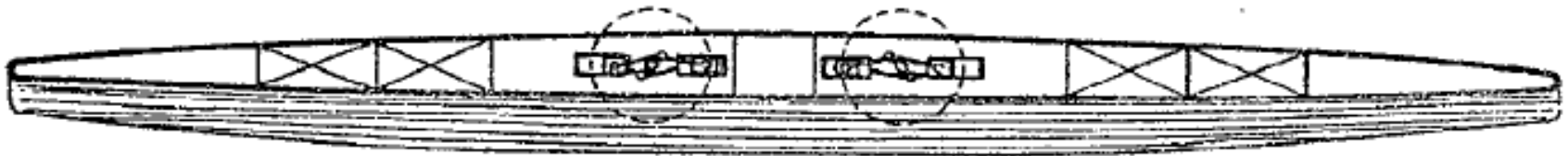
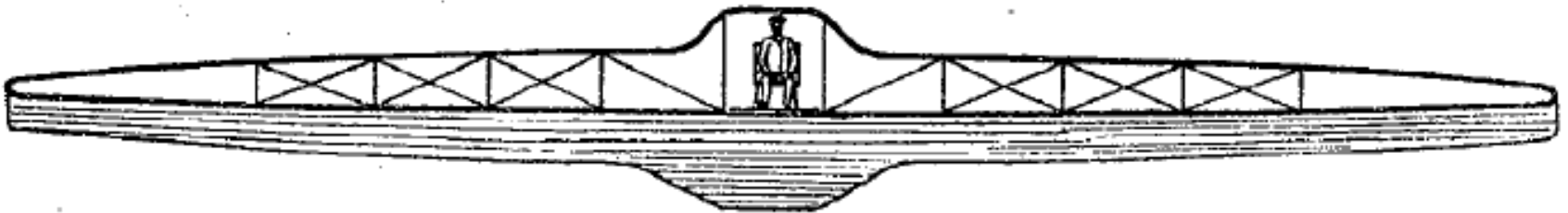


Fig. 6.

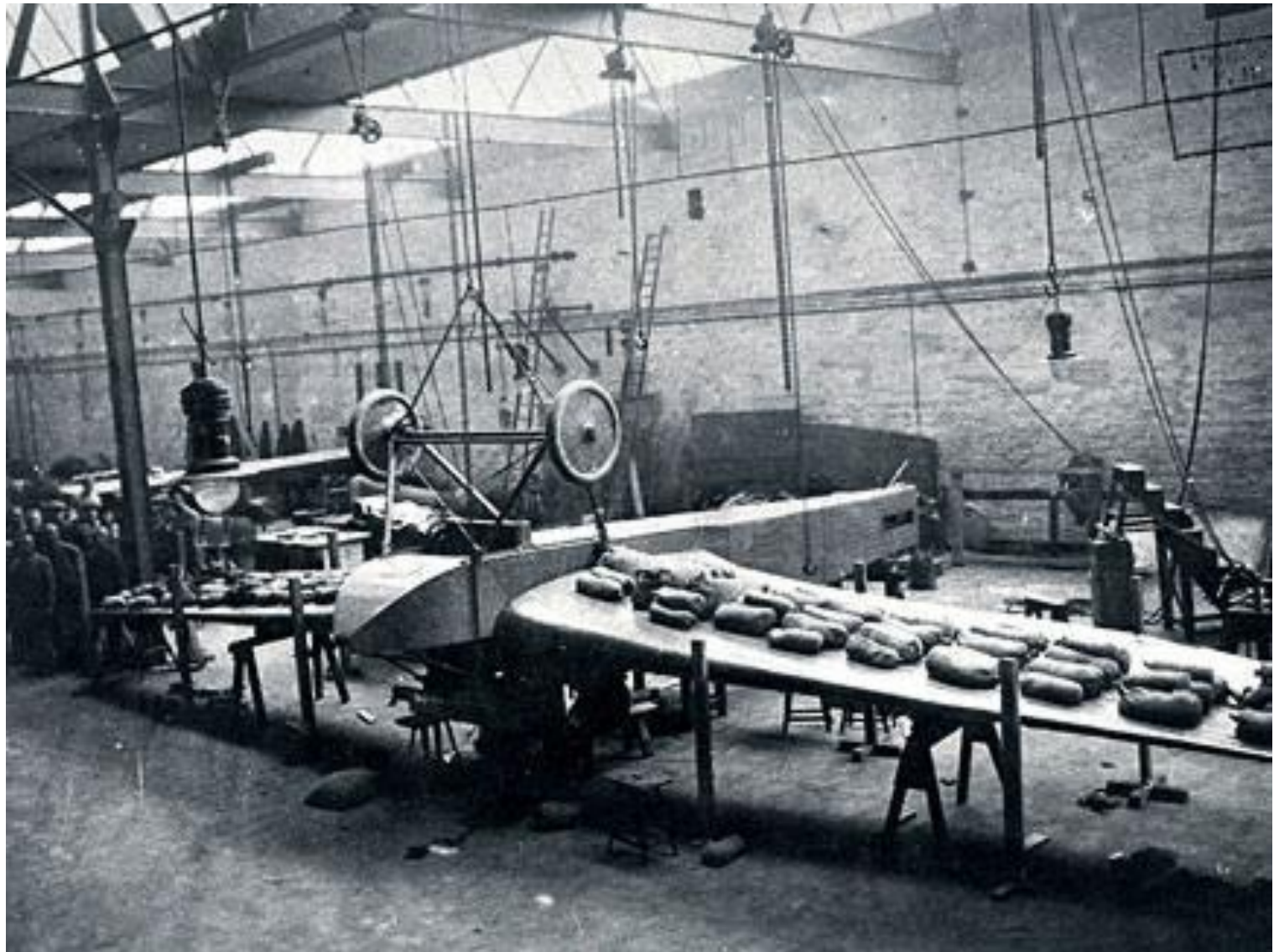


First All-Metal Airplane?

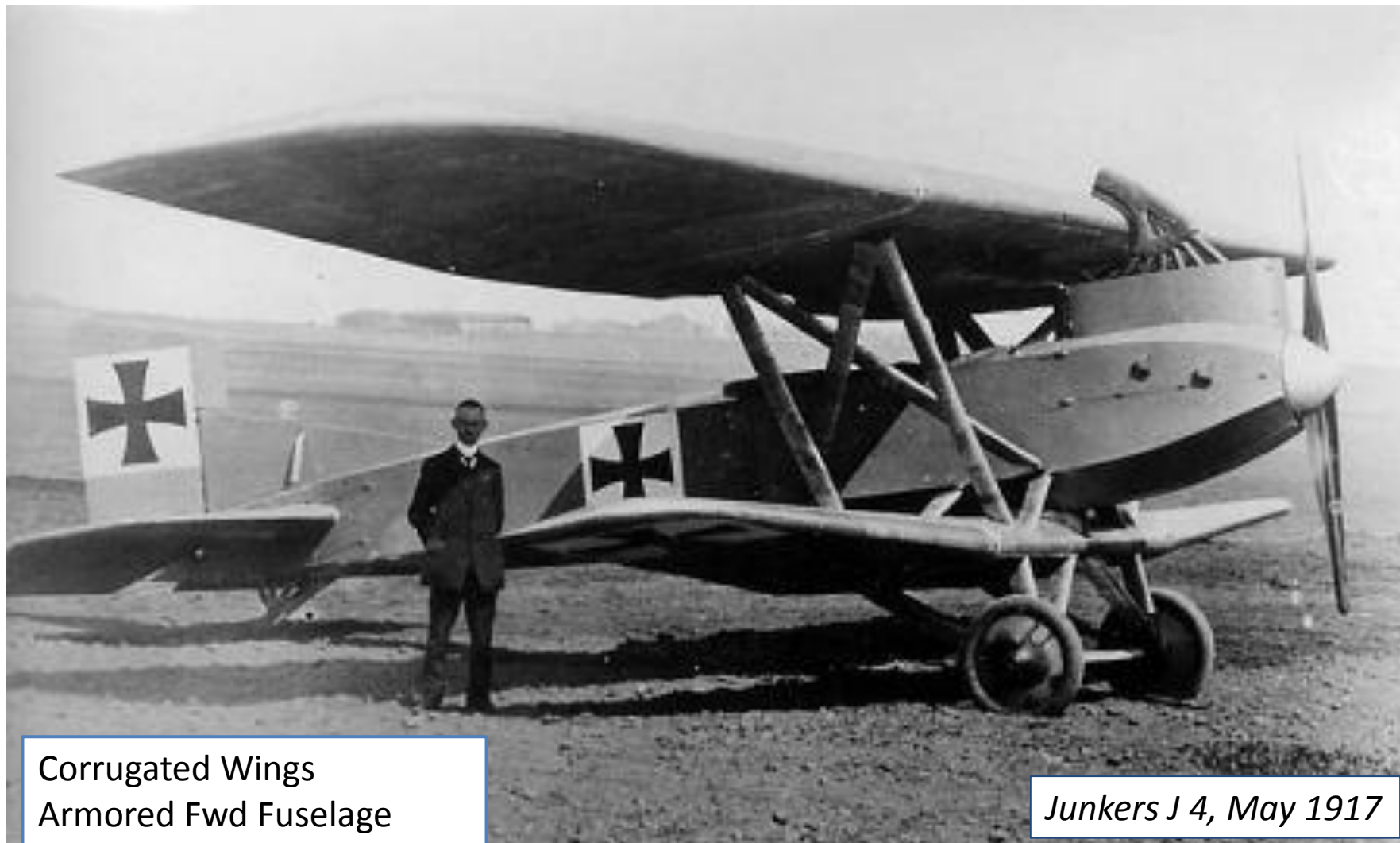


Junkers J 1, Dec. 1915

Testing the J1 Wing



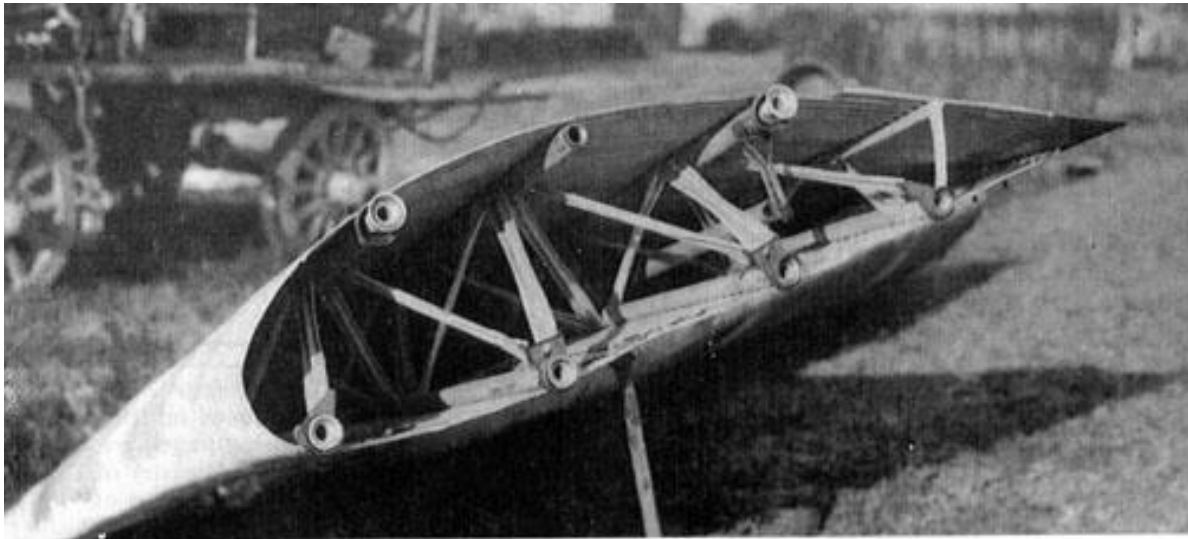
A Metal Biplane!



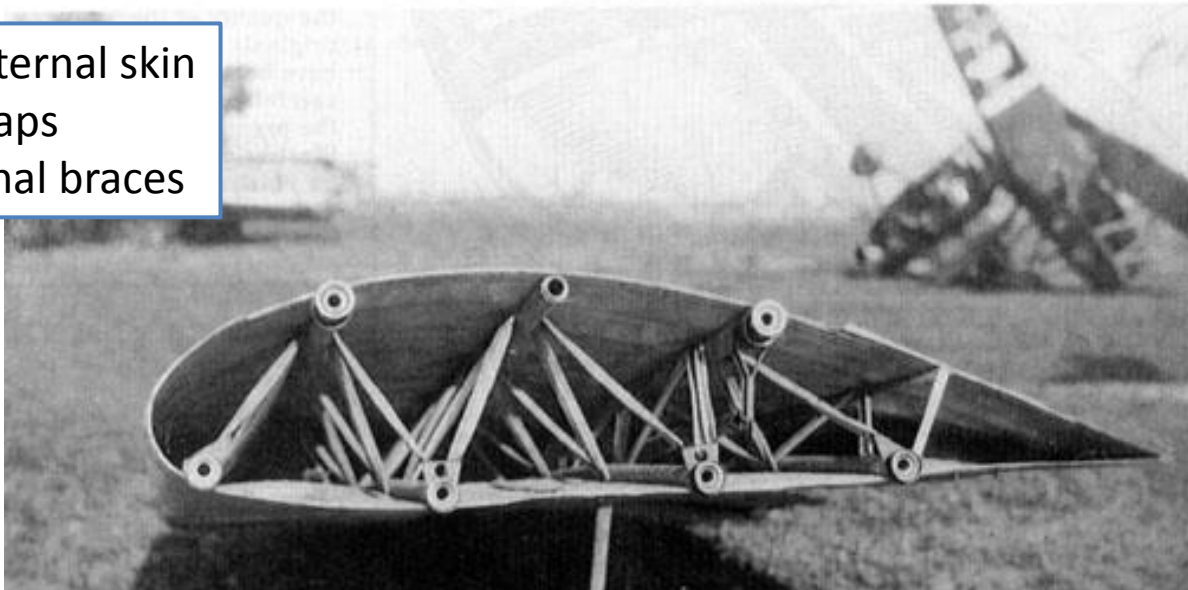
Corrugated Wings
Armored Fwd Fuselage
Fabric Covered Aft Fuselage

Junkers J 4, May 1917

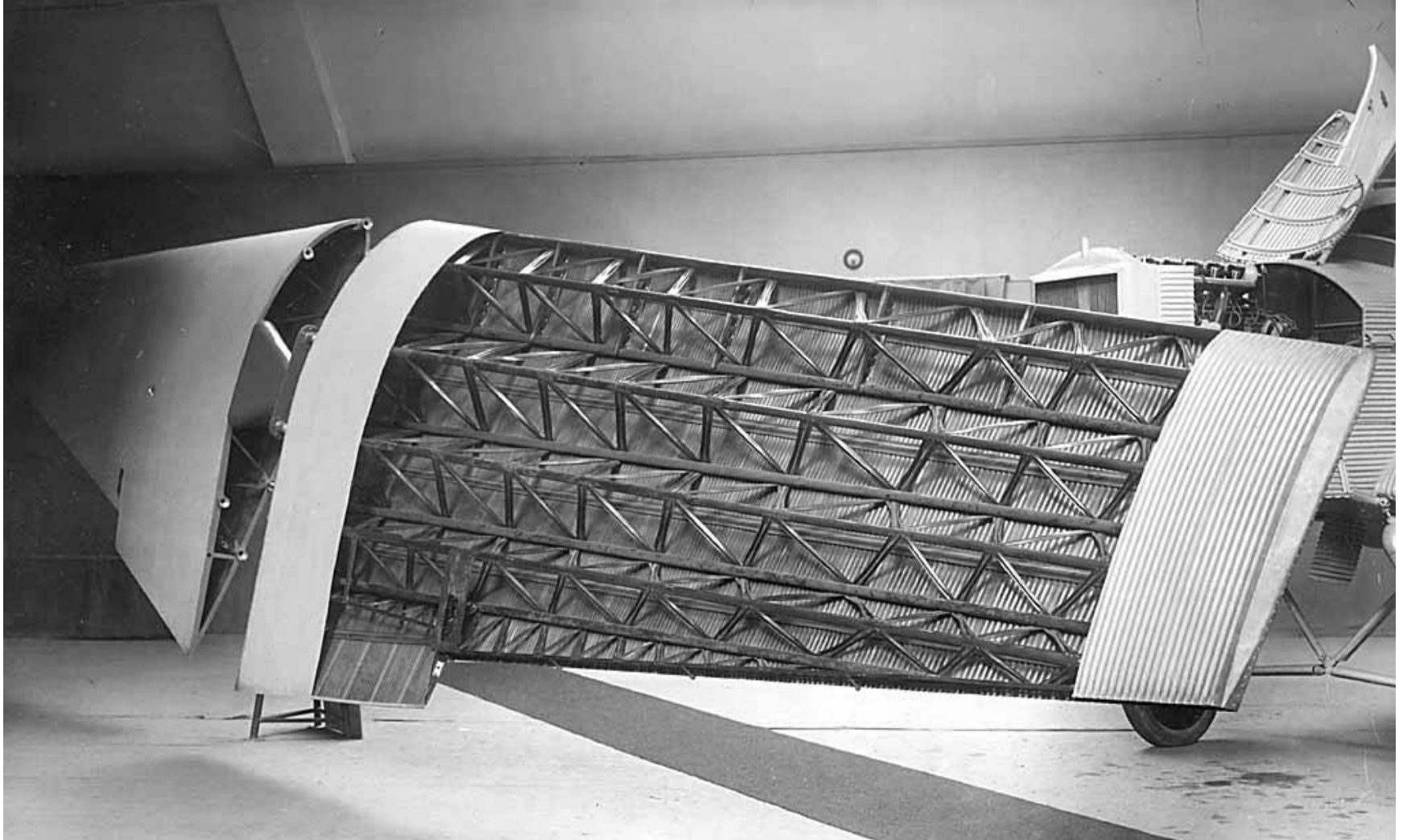
Junkers Wing Construction



Corrugated external skin
Tubular spar caps
Formed diagonal braces

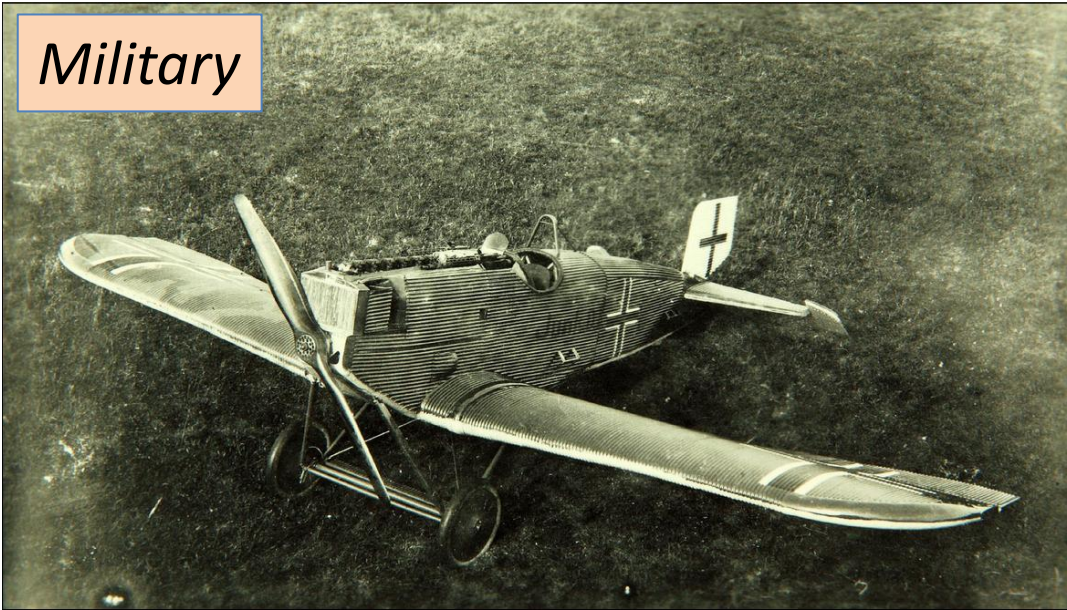


Junkers Wing Construction

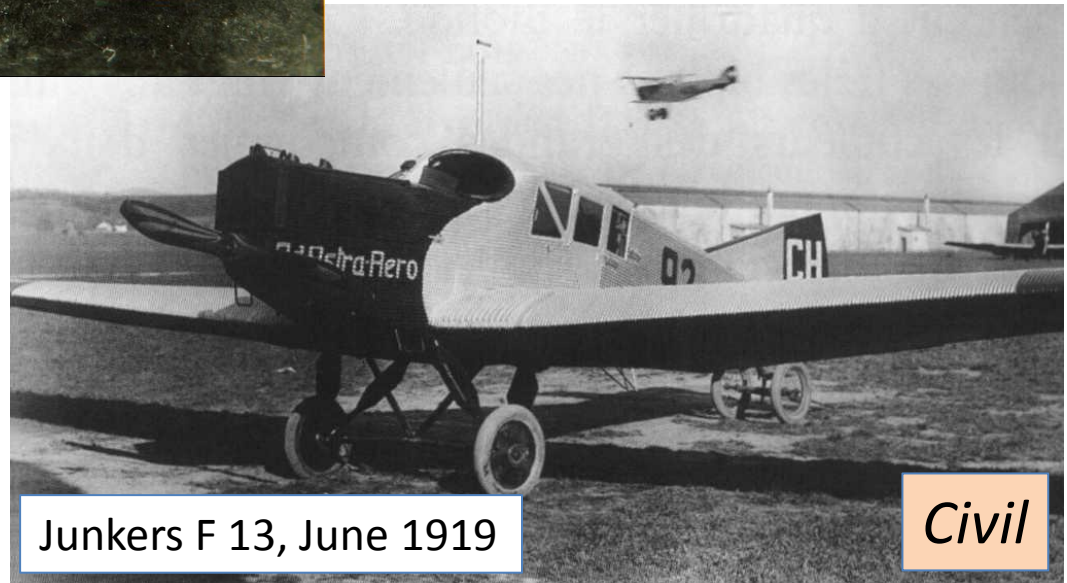


Post-War Transition

Military



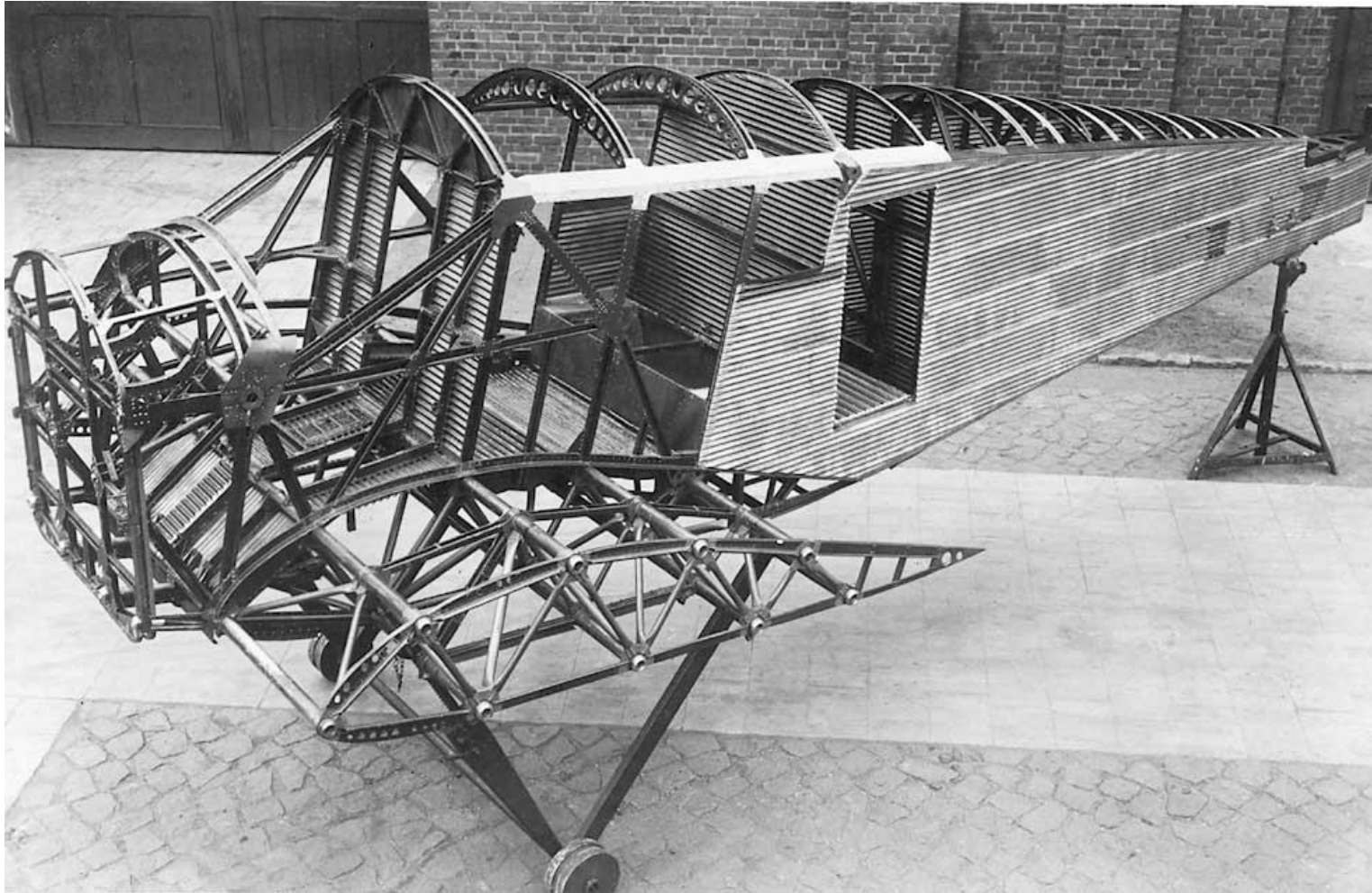
Junkers D 1, July 1918



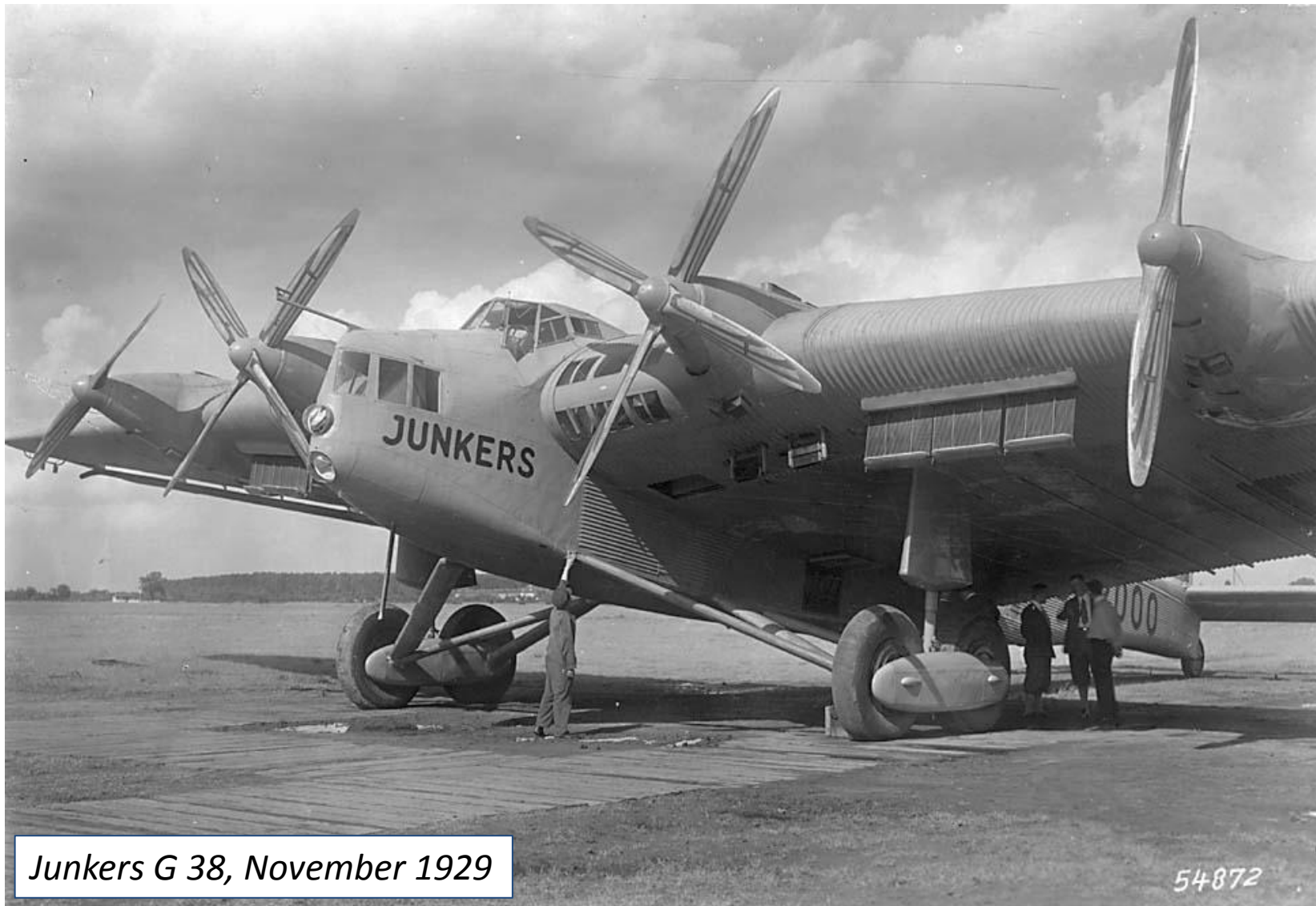
Junkers F 13, June 1919

Civil

Junkers Airframe Construction



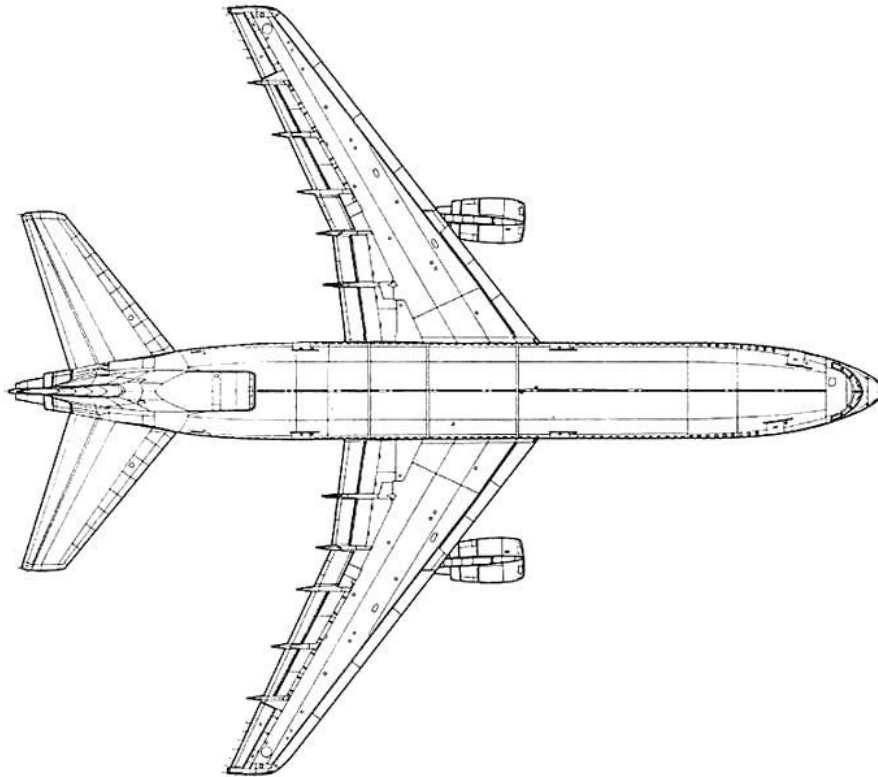
Scaled Up



Junkers G 38, November 1929

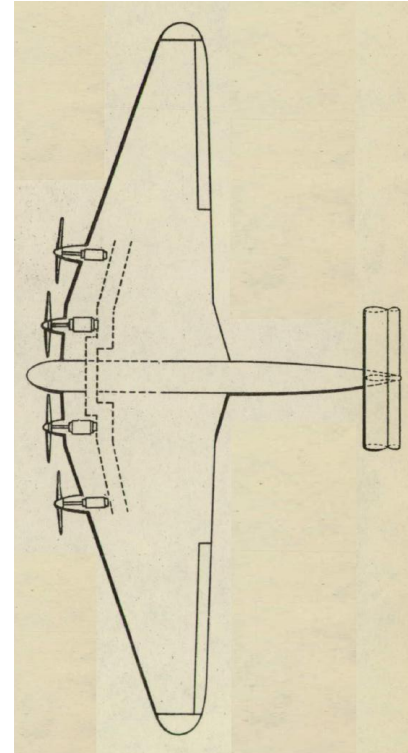
54872

Largest Landplane of the Day



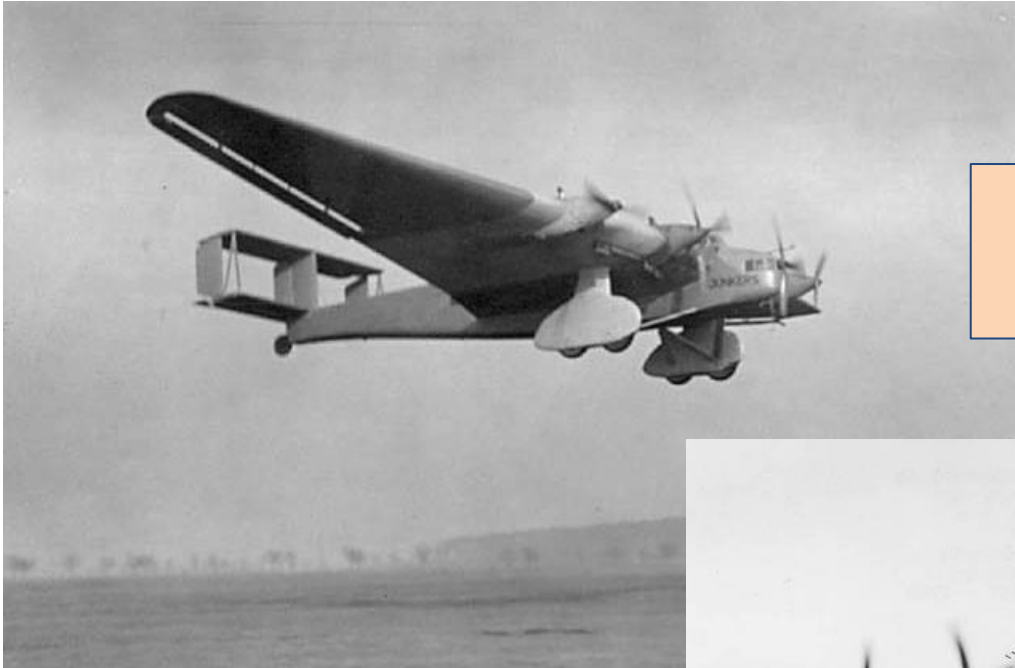
Lockheed L-1011

144'



Junkers G 38

Think Big!

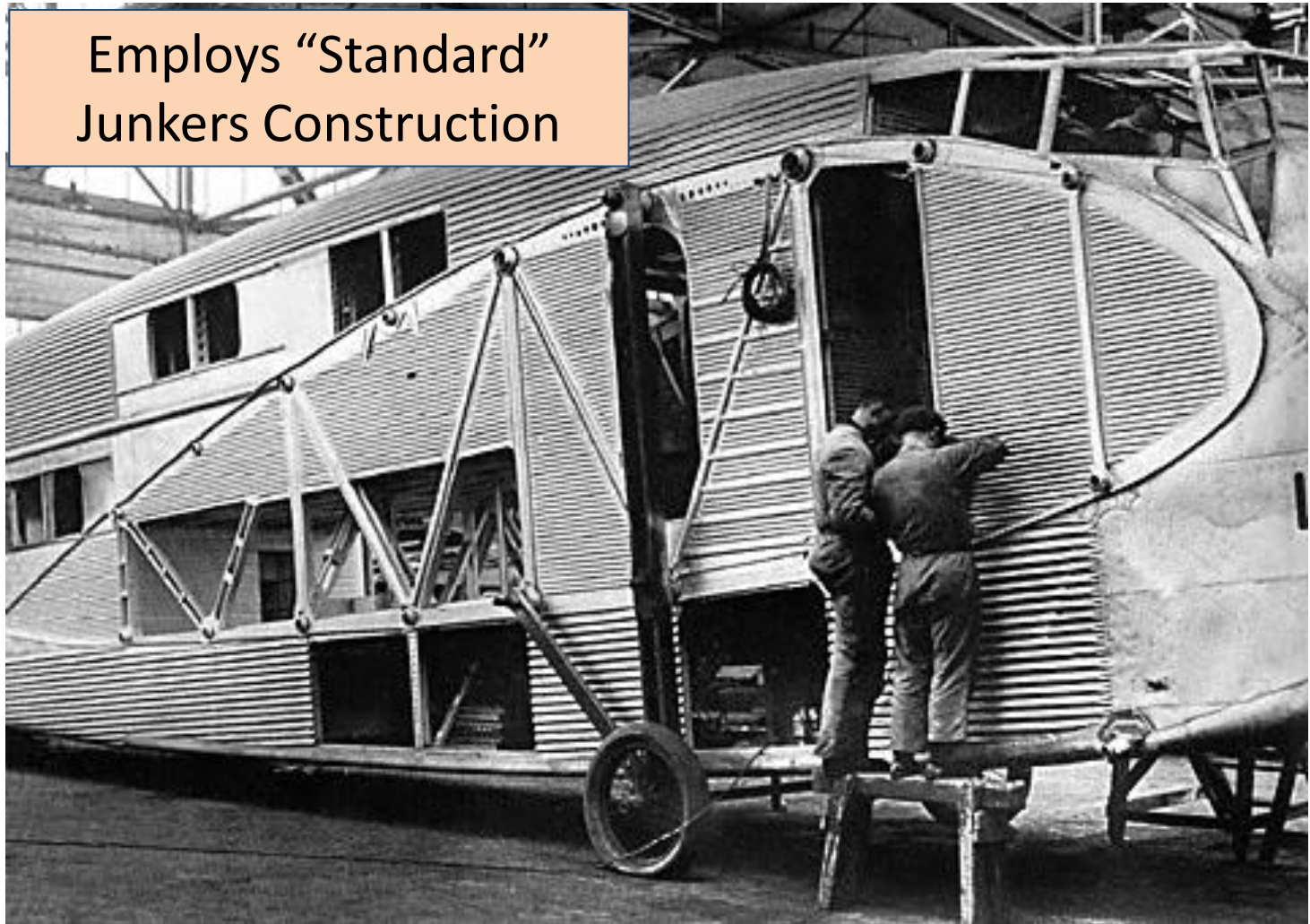


Approaching Junkers
1910 Patent Ideas

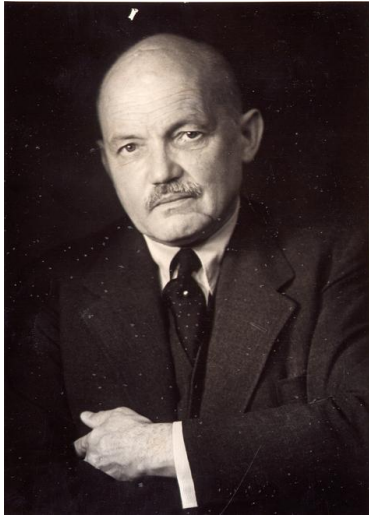


Very Deep Wing

Employs “Standard”
Junkers Construction



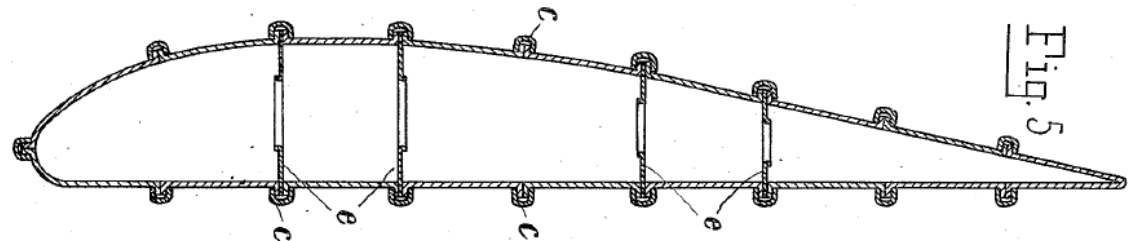
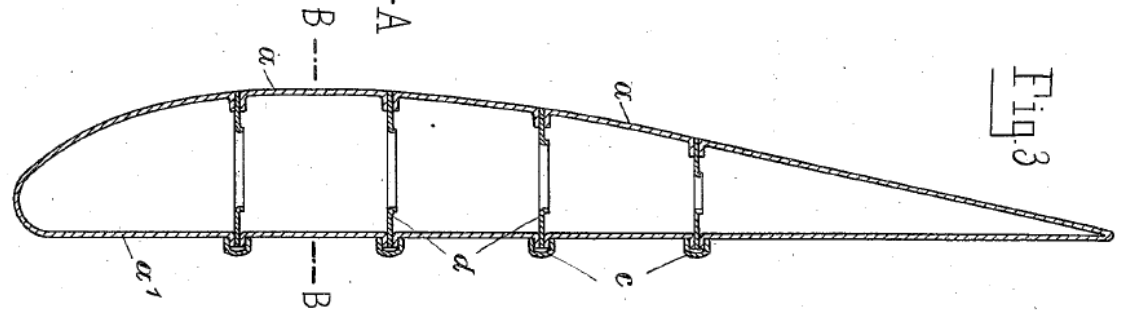
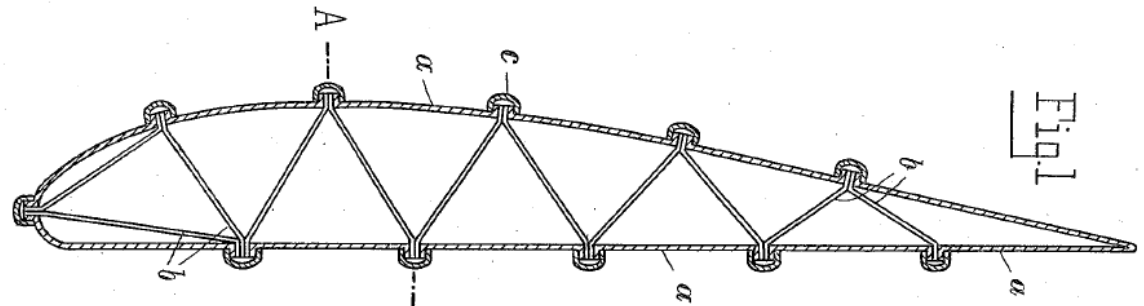
Claudius Dornier



1884-1969

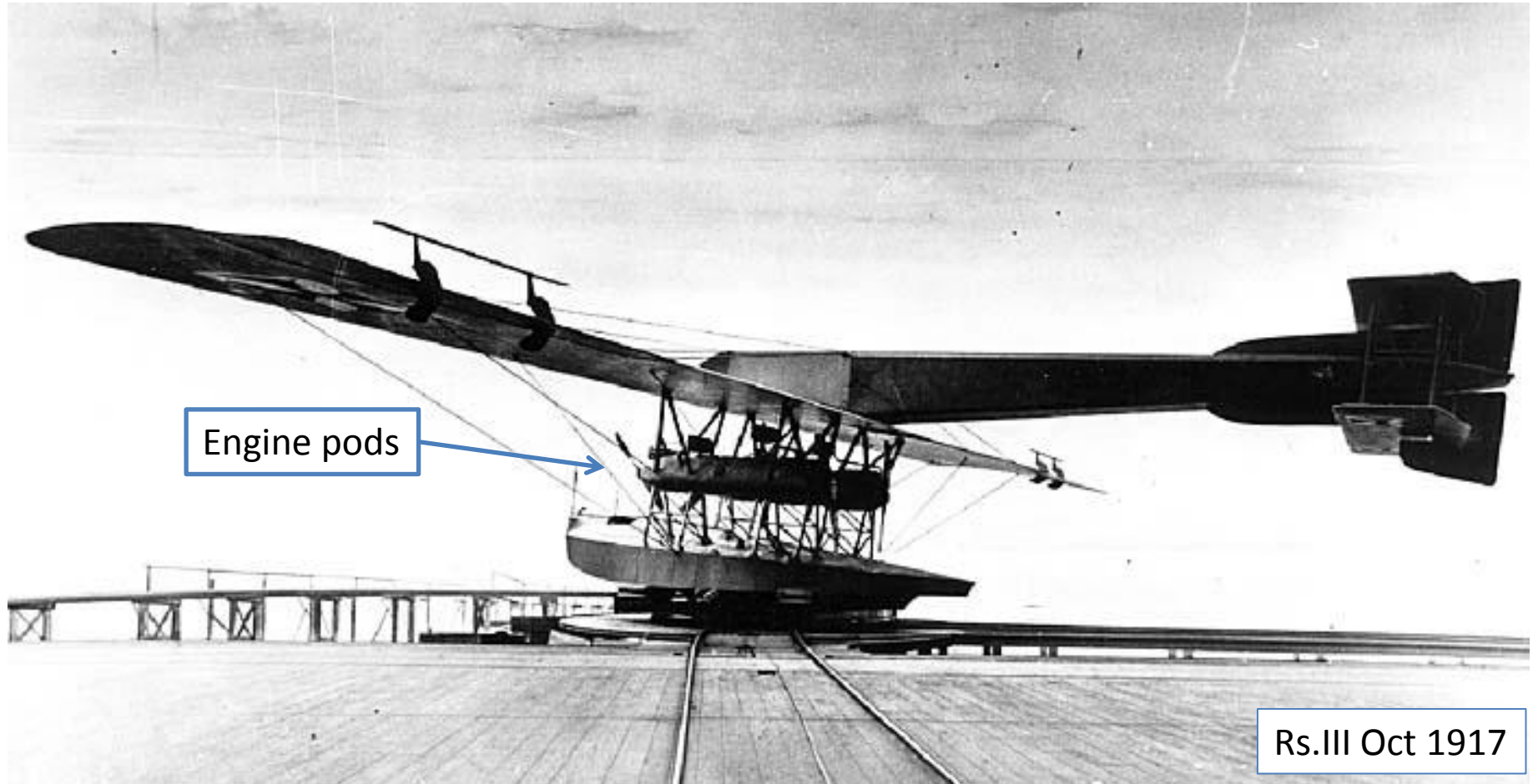


Patent Filed Nov 1922



WWI Giant Flying Boat

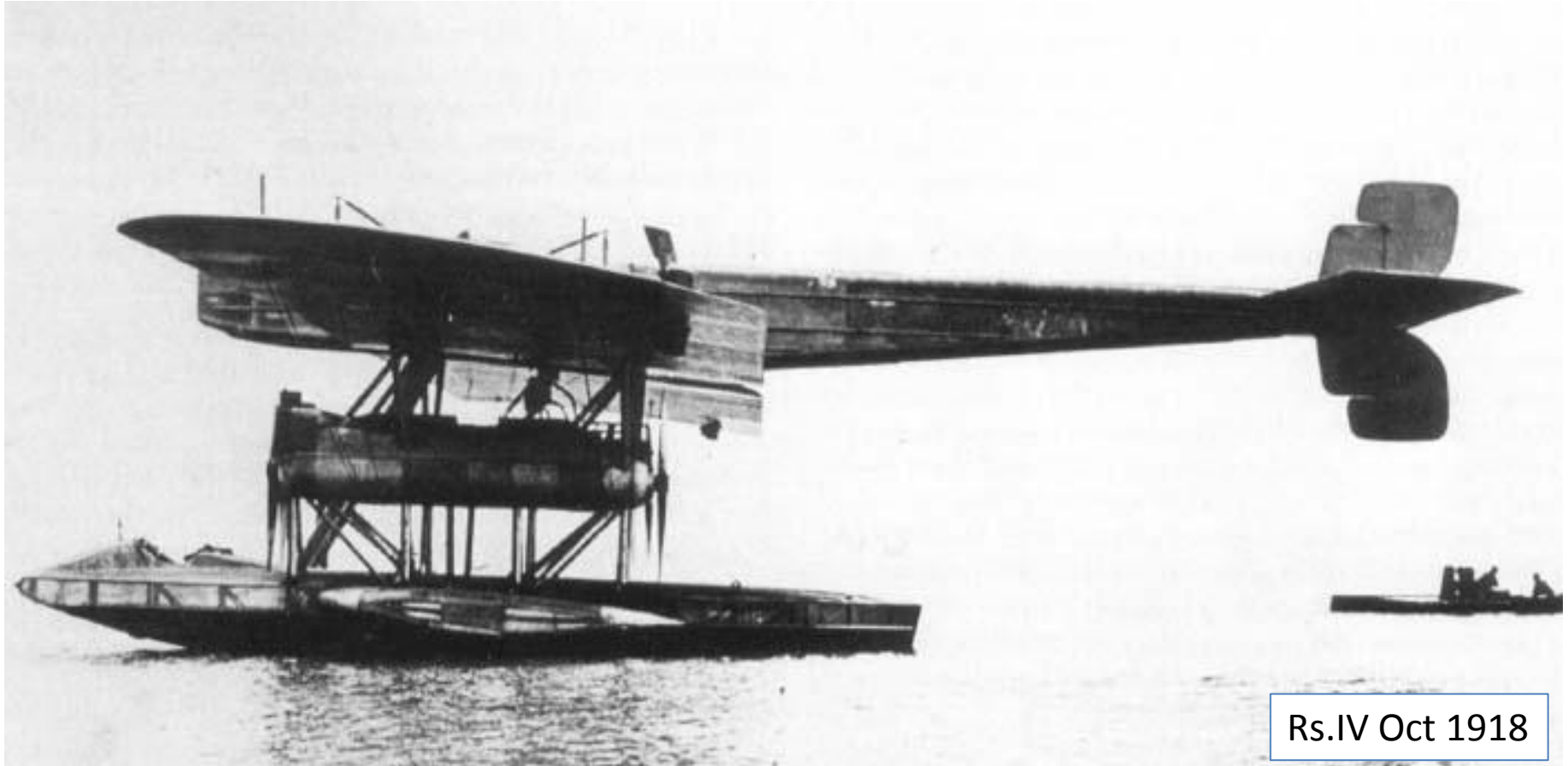
Dornier worked at Zeppelin-Werke Lindau



Engine pods

Rs.III Oct 1917

Another One (There were 4)

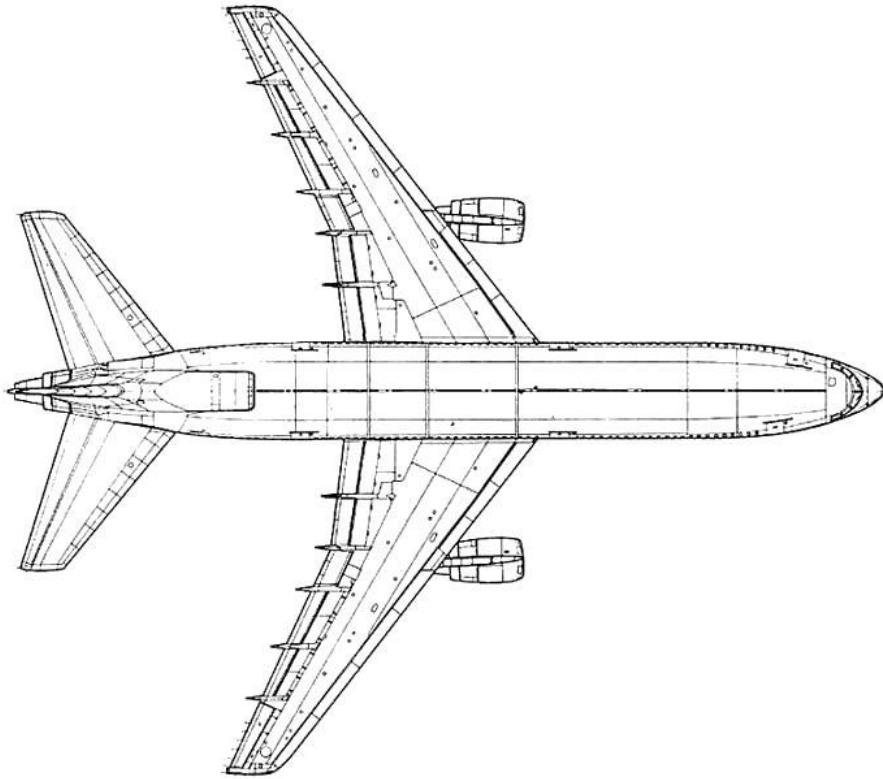


Rs.IV Oct 1918

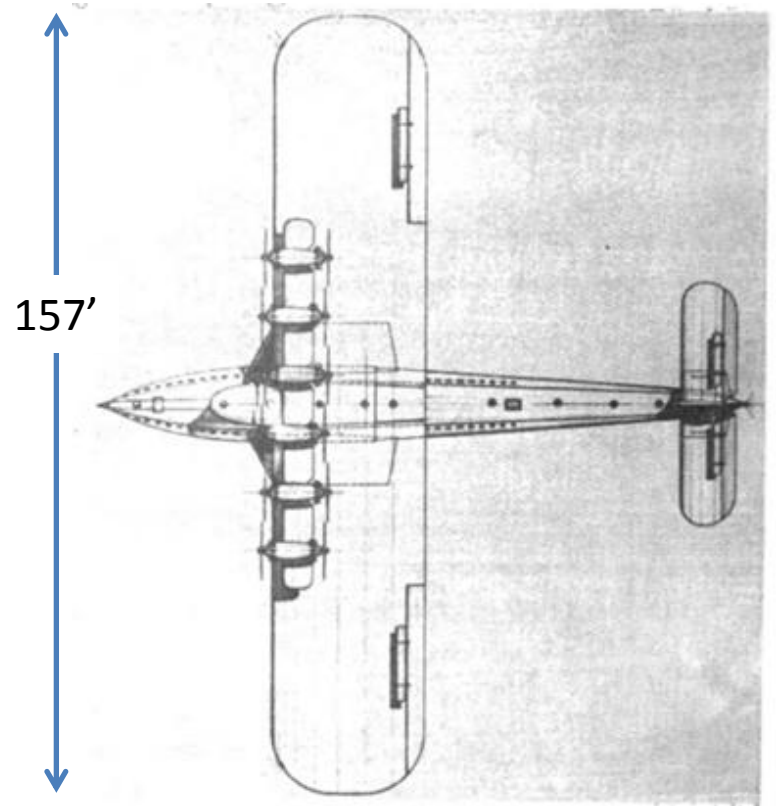
Post-War Commercial Flying Boat



Largest Seaplane of the Day

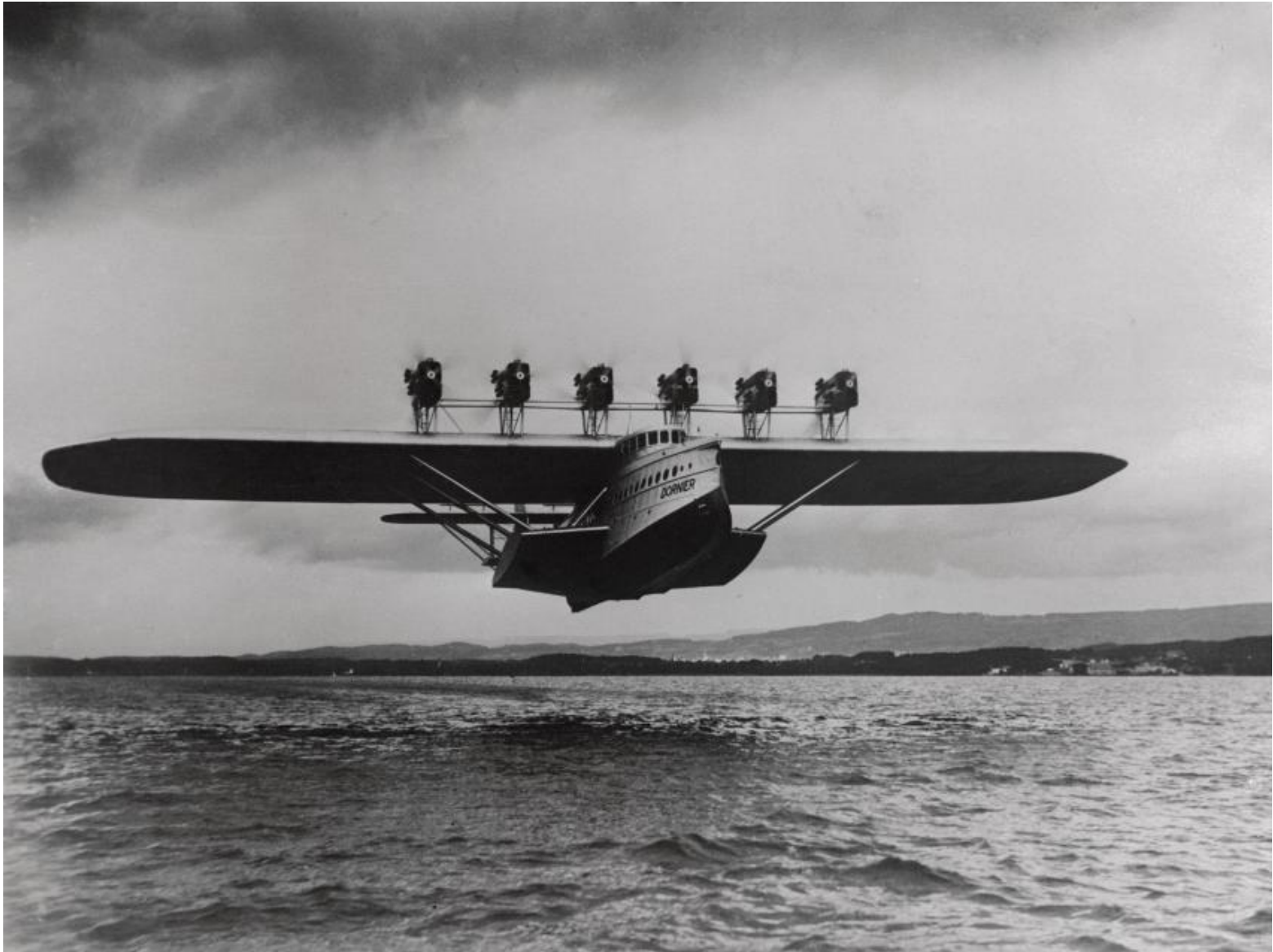


Lockheed L-1011



Dornier Do X

Taking Off



Travel in Style!

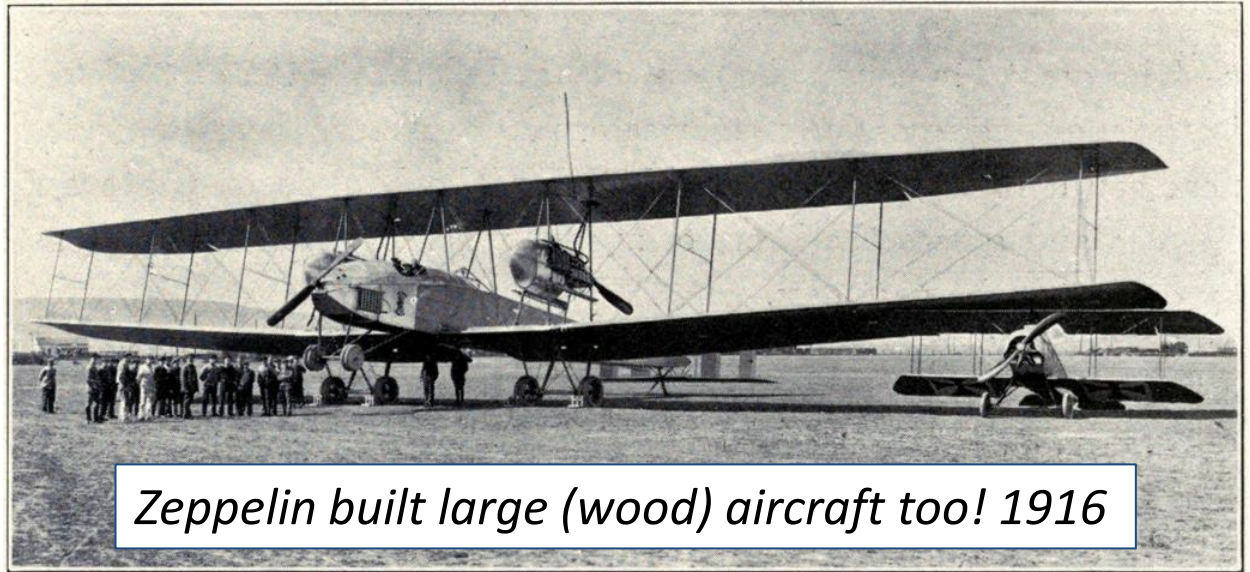


Adolf Rohrbach

Rohrbach worked at Zeppelin-Werke Staaken



1889-1939



Rollout of the E4/20

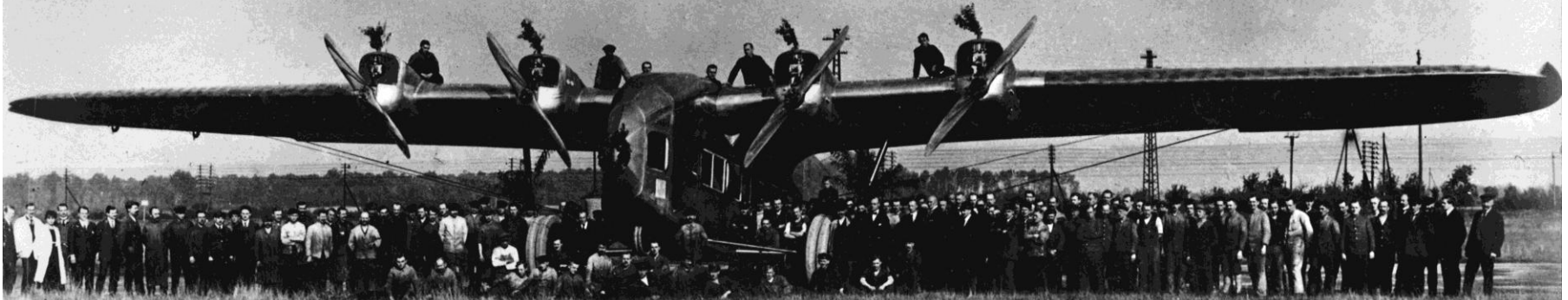
**L'AVION MONOPLAN « STAAKEN »
de 1 000 chevaux, des Chantiers Zeppelin.**

**Das 1000 PS-Verkehrsflugzeug
der Zeppelin-Werke, Staaken.¹⁾**

Von A. K. Rohrbach.

The Zeppelin-Staaken 1000 Hp. Monoplane

Sep 1920



**The Zeppelin Giant
Monoplane**

By E. Sinclair Puckett

LE MONOPLAN “ ZEPPELIN-STAAKEN ”

THE NEW STAAKEN MONOPLANE

An Interesting German All-Metal Machine

**THE 1000 H.P. PASSENGER-CARRYING AEROPLANE OF
THE ZEPPELIN WORKS IN STAAKEN**

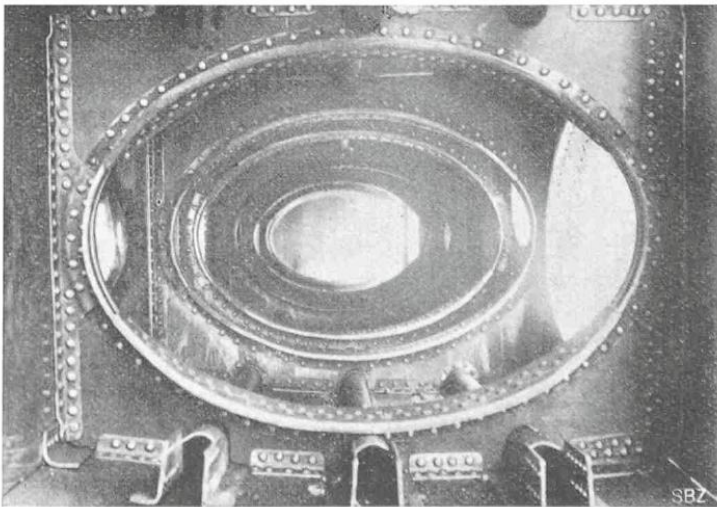
By Dr. ing. Ad. K. Rohrbach, Charlottenburg.

THE 1,000 H.P. ZEPPELIN MONOPLANE

By DR. ALFRED GRADENWITZ

**Das 1000 PS-Verkehrsflugzeug
der Zeppelinwerke.**

E4/20 Wing Structure



Stiffened external skins
3 cell wing box
Fabric Covered LE & TE

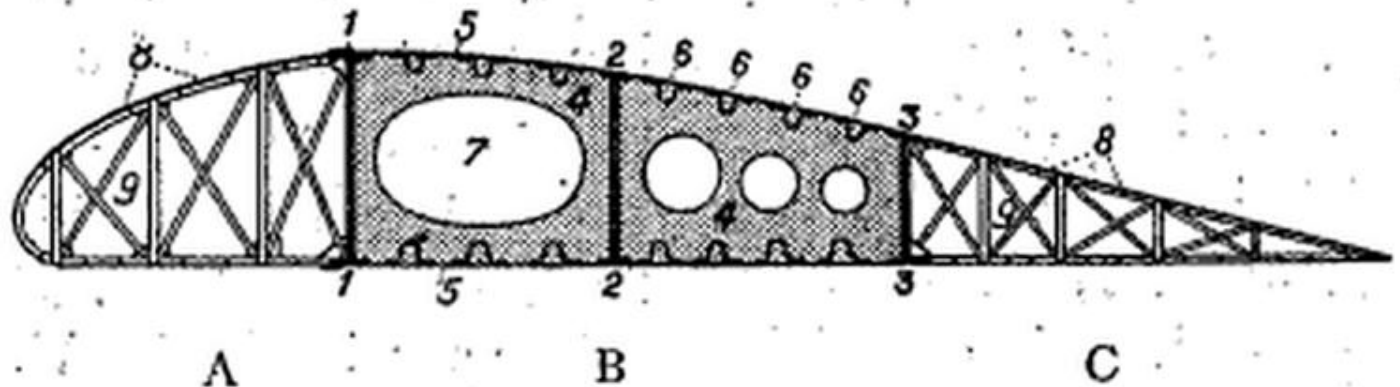
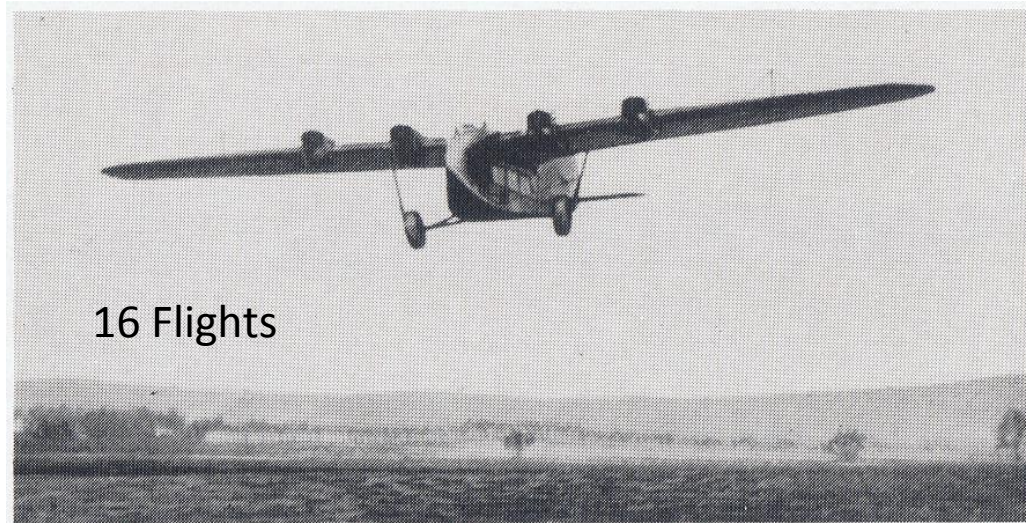
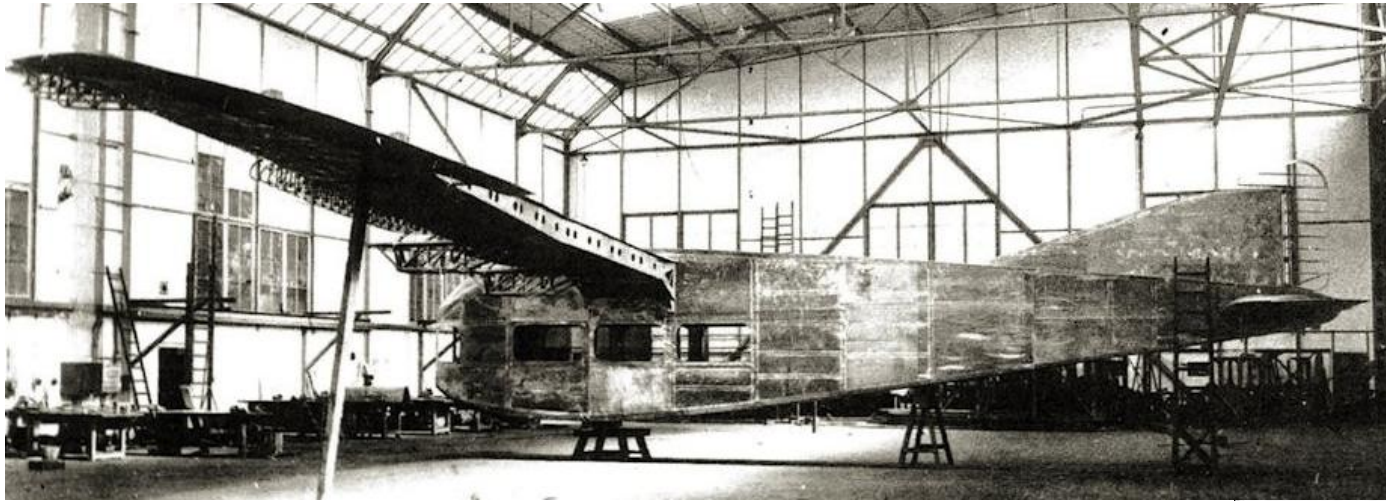


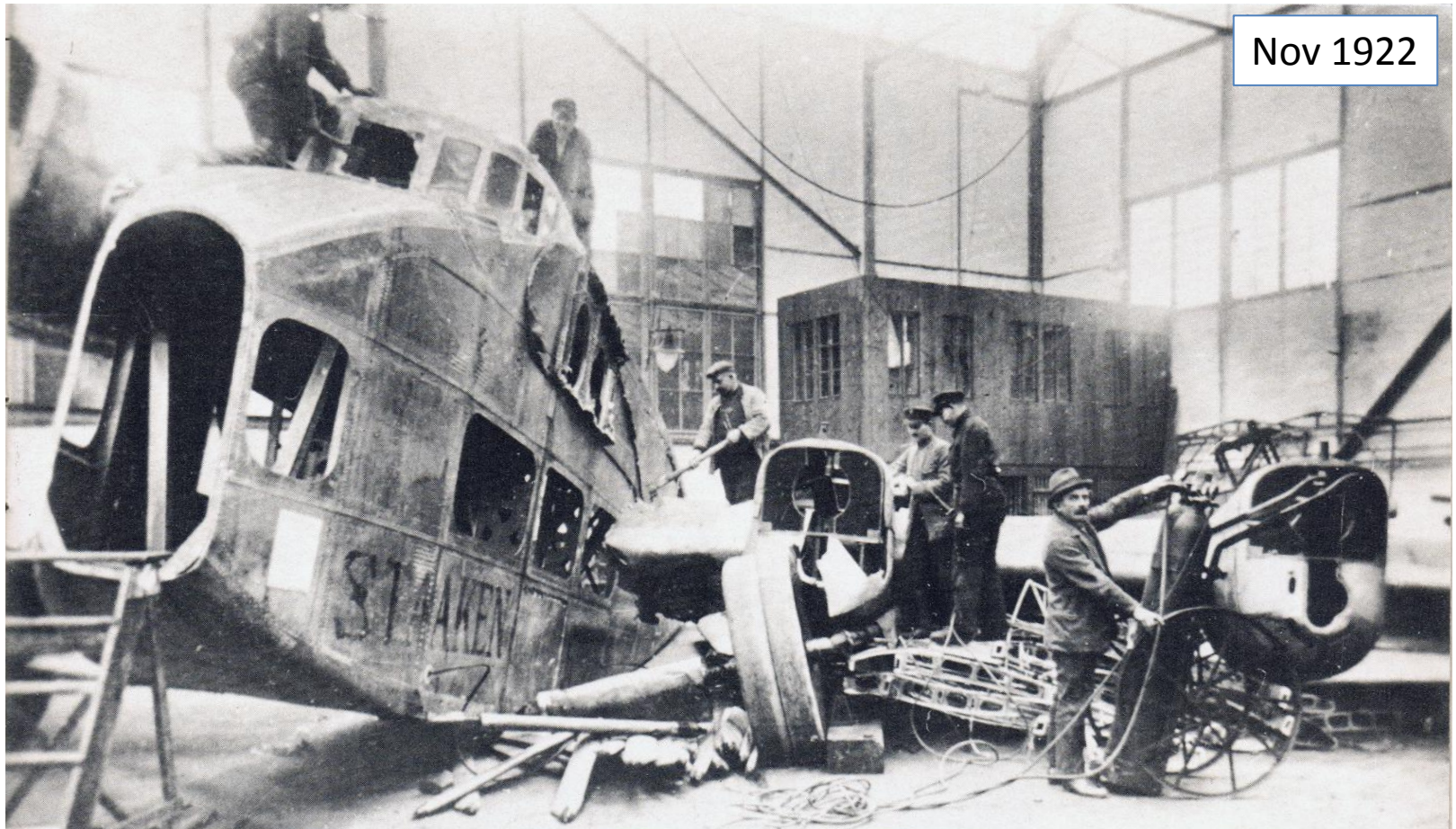
Fig. 15. — Coupe du plan du Zeppelin-Staaken montrant la méthode de la construction par caisson.

E4/20 Construction & Flight

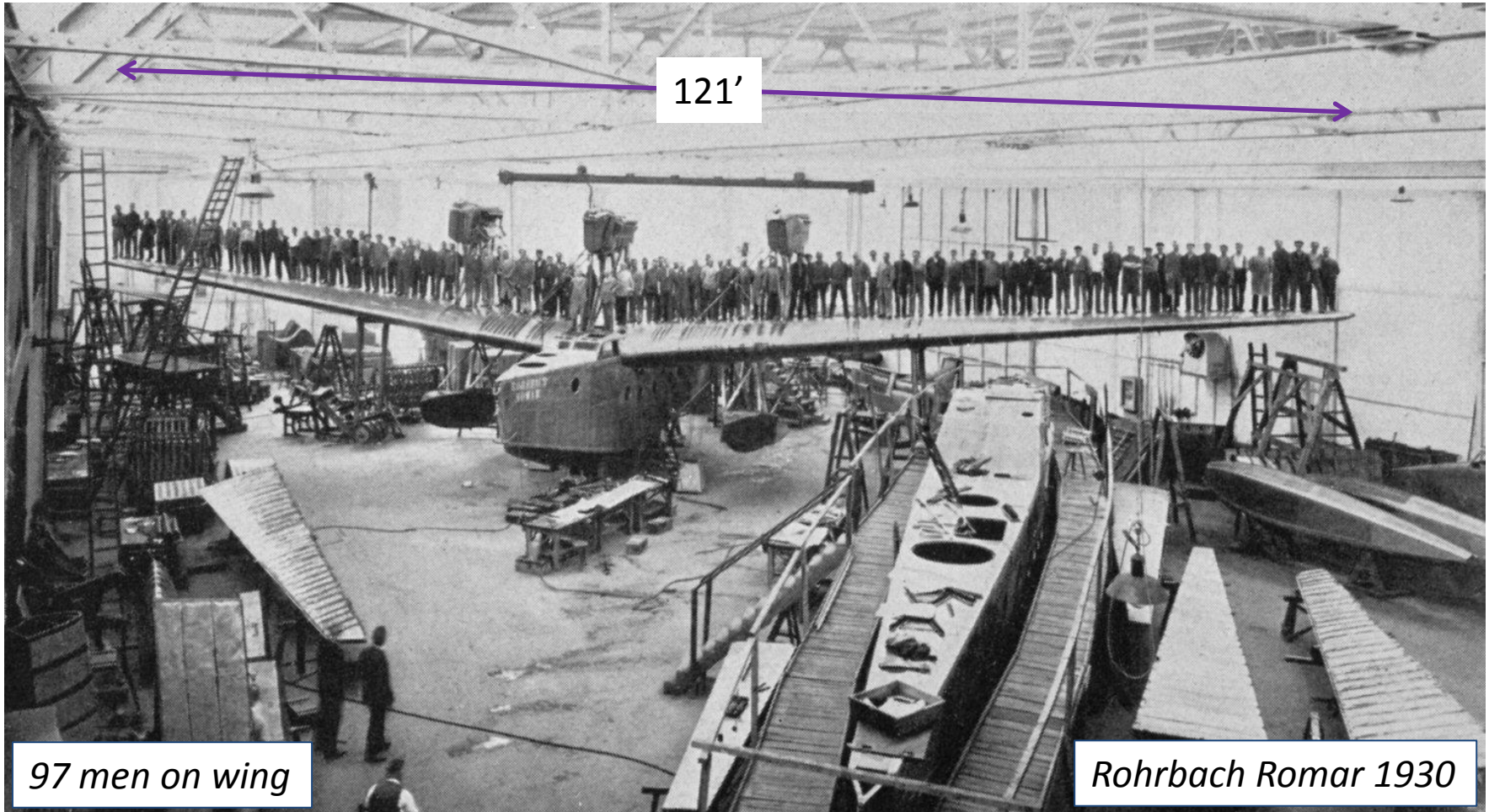


16 Flights

Scrapped by Order of the Allies



Another Giant Flying Boat

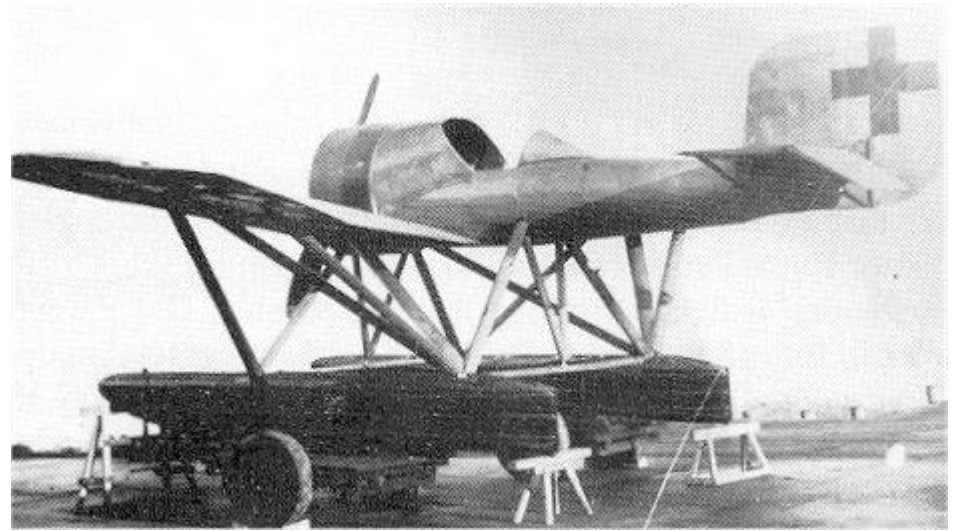


97 men on wing

Rohrbach Romar 1930

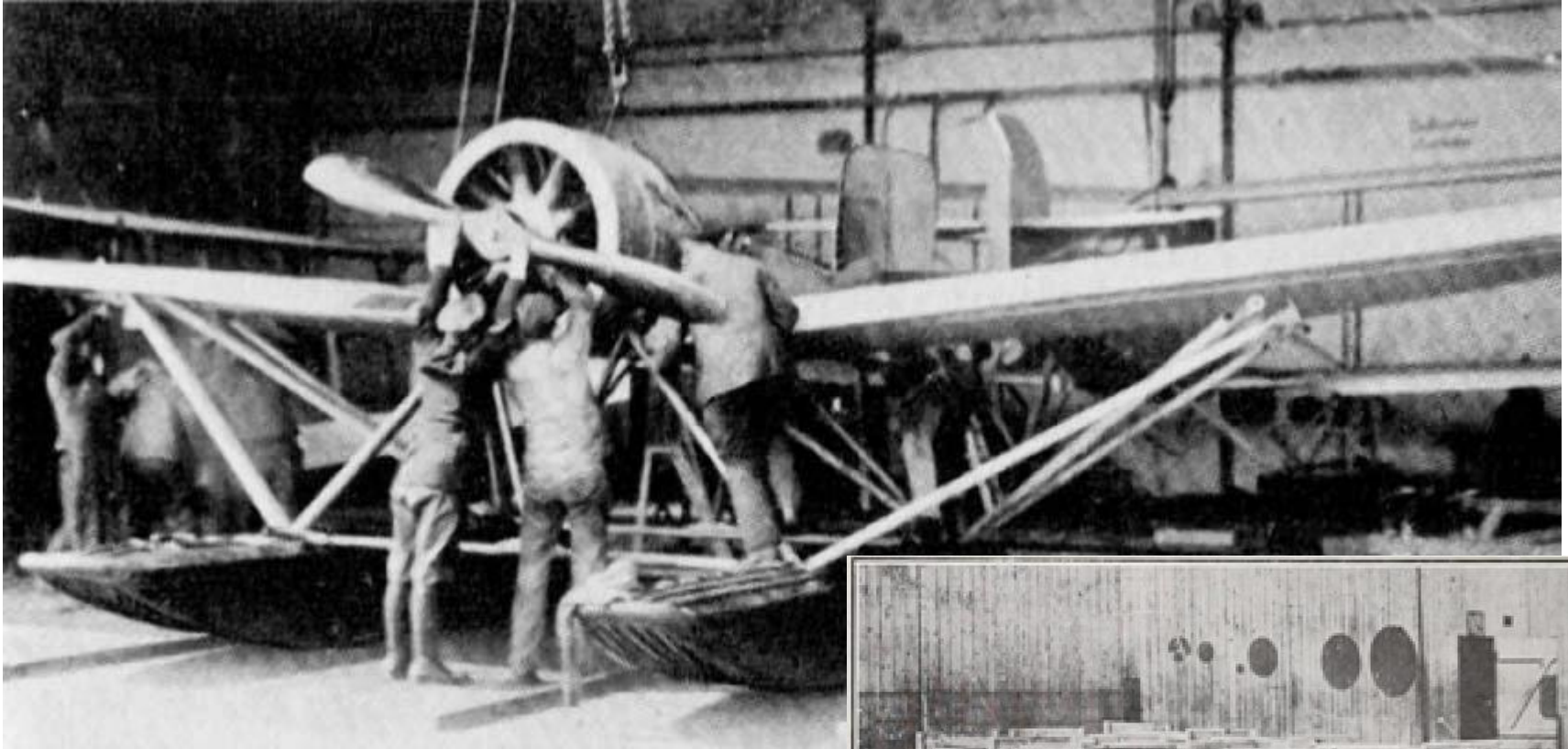
And Now... From Large to Small

Luft Fahrzeug Gesellschaft (LFG)

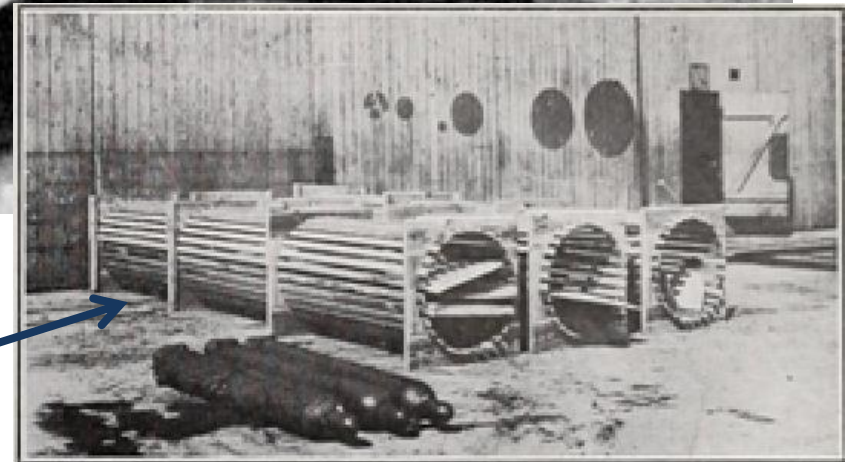


LFG V19 "Putbus"
Scout Plane

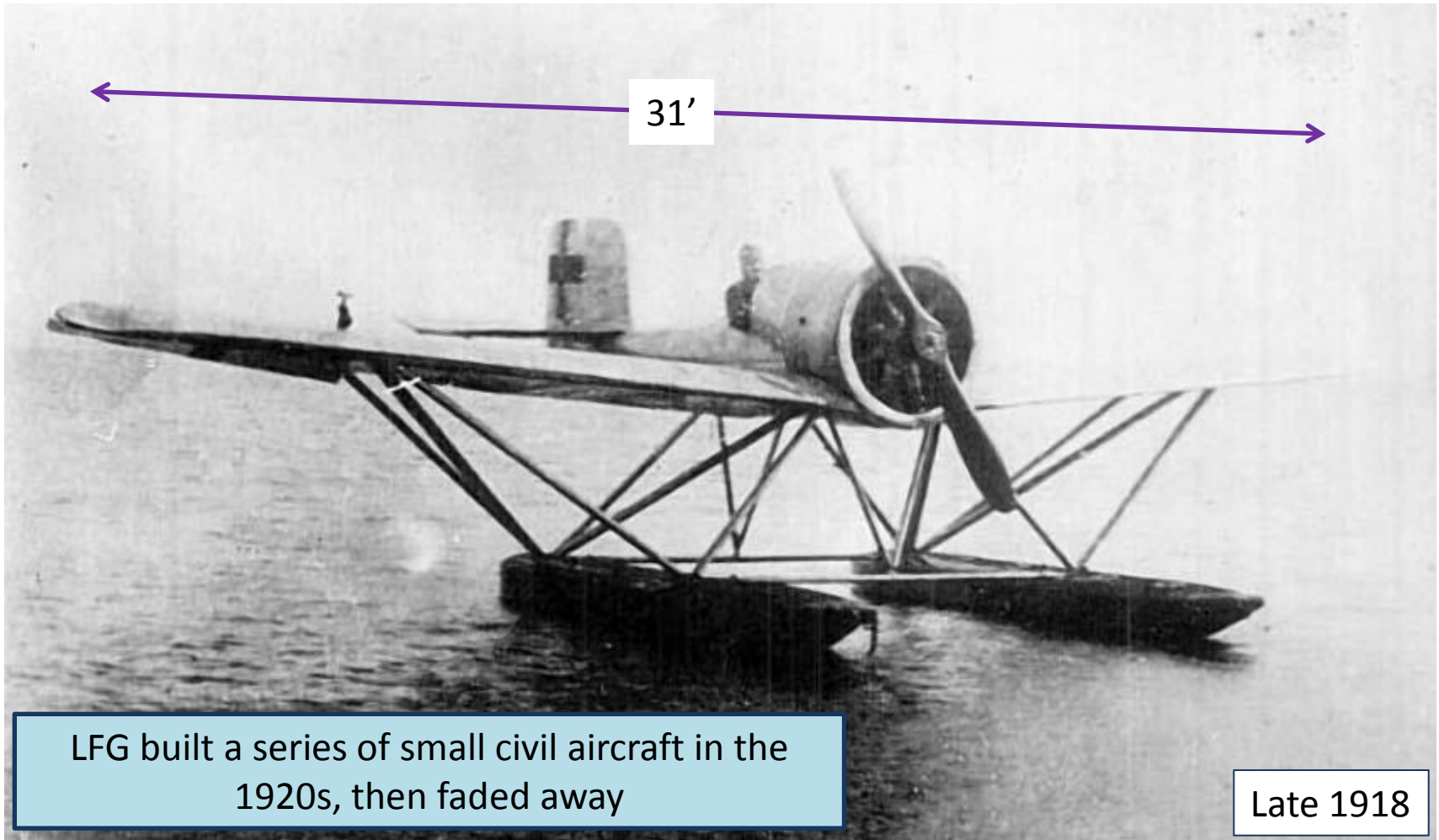
Launched from a Submarine



On-Board Storage
Containers



Too late for World War One



LFG built a series of small civil aircraft in the 1920s, then faded away

Late 1918

Summary

- The German metals industry started developing strong aluminum alloys in early 1900s
- German designers embraced aluminum for aircraft structures in late World War One
- People like Junkers, Dornier & Rohrbach popularized metal aircraft and advocated large commercial transports for improved economy