A History of the Development of
The Variable Pitch Propeller
by
Patrick Hassell
RAeS Hamburg 26th April 2012
DRZEWIECKI’S STRIP THEORY – 1892
NPL AIRSCREW WITH 'RAF 6' SECTIONS — 1916

Sketch of a Blade of Airscrew A

Diameter of Airscrew 8 Feet

Lines .06 all in one plane normal to axis of airscrew.

Scale for plan view — 3 ft

Scale for sectional views — 6 ft
R.E. FROUDE’s ‘ACTUATOR DISC’
THEORY – 1889

V

V(1+a)

V(1+2a)

STATIC PRESSURE

P_A
COMBINED OR "INFLOW" THEORY — 1917

L

D

\omega R

\alpha

\phi \phi_0

W

Wo

V

aV

REF: R & M 328; A. FAGE AND H.E. COLLINS
Negative Blade Angle of Attack (Windmilling)
Three Fundamental Design Problems:

1) How to retain the separate VP blades

2) How to change pitch and provide the effort to do so

3) How to match the pitch to the flight/power condition
Supermarine S-6B - Fairey-Reed Propeller
Experimental Chauviere VP Airscrew c.1913
Lynam’s Experimental VP airscrew on SE-5a - c.1917
Lynam’s VP propeller for BE-2c - c.1917
Bolted blade root
Blade Retention by Ball Race
Blade Actuation by Yoke and Pushrods
Manual Control System
SE-5A  Manual Control by Worm Gear
Bristol VP Propeller
Jupiter engine 1924
Turbocharged Bristol Jupiter III

c.1923
Bristol Seely Tourer with Jupiter III T
Bristol VP Propeller
1924

Root detail of Leitner-Watts blade
Bristol Mechanically Actuated VP Propeller - 1924
Hele-Shaw
Constant speed
VP airscrew

1924
H L “Pop” Milner

Propeller Designer

worked at:
RAE Farnborough
Hele-Shaw
Gloster Aircraft Co.
Bristol Aeroplane Co.
Rotol Ltd
Gloster’s Hele-Shaw propeller - 1927
Boeing 247 of United Airlines -1933
De Havilland DH.88 Comet Racer - 1934
Experimental
US Army
Propeller

Wright Field
c.1925
Effect of Counterweights
Caldwell (Hamilton) “Bracket” Prop
Douglas DC-1 with Hamilton Standard bracket propeller
Frank Caldwell receiving the 1933 Collier Trophy from FDR
Bristol Type 142 with original propellers - April 1935
Bristol Bulldog FTB

Mercury engine and HS “bracket” propeller as for Type 142
Bristol Blenheim IV with DH bracket propeller 1939
The finished office block in March 1938. The ‘White Block’ was originally designed to receive another storey, which it did in 1951.

Rotol Factory at Staverton, Gloucester, 1938
(now Messier-Dowty landing gear)
Vickers Wellesley with Rotol airscrew - Egypt 1938
RAF Long Range Development Flight
Rotol External Cylinder Constant-speed Airscrew
Rotol 5-blade
External Cylinder
Airspew
Lockheed YP-38
1940
Curtiss Electric propellers
Rotol / Curtiss Electric Propeller
Curtiss Electric “Doughnut” propeller
Lockheed C-130A with Aeroproducts propellers - 1956
Bell P-39 Airacobra
VDM Propeller with external electric drive - 1939
VDM Propeller pitch change mechanism
Hamilton Standard “Hydromatic” propeller hub
Hydromatic cylinder, cams and gear drive
Spitfire with Rotol 5-blade airscrew - 1944
Experimental Meteor with R-R B.50 Trent turboprops
Vickers Viscount  R-R Darts with Rotol propellers - 1948
Tyne Lincoln FTB with DH Hydromatic propeller
Hamilton 54H60 propeller

Lockheed C-130B-H
Lockheed P-3 Orion
De Havilland Comet 1  1st Jet Airline Service - May 1952
McDonnell XF-88B Voodoo - 1953
Typical Hartzell GA prop on Mitsubishi Mu-2
Dowty Rotol propeller on BAe Jetstream 31 c.1982
Hamilton metal-spar composite-shell propeller c.1982
Section of Dowty all-composite propeller blade
Dowty Composite Blade Root c.1980
ATR-42 Hamilton Standard part-composite blades 1983
Dowty composite bladed propeller for Saab 340 1983
Fokker 50 with Dowty computer-controlled 6-bladers
Saab 2000 High-speed Turboprop - 1992
Dowty 6-blade swept propellers with integrated electronic control
Dowty 6-blade propeller for Lockheed C-130J Hercules
General Electric GE36 UDF “Unducted Fan” on Douglas MD-80 FTB - 1988
Pratt / Allison 578DX Propfan Demonstrator
Last Touchdown  Filton 26 November 2003
Rolls-Royce Open Rotor Pusher Concept - 2011
Airbus A400M  Ratier 8-blade propellers
Next Generation Airliner - circa 20xx ??