

1	Introduction	1
2	Survey	9
2.1	Gas Turbine/Turbojet Timeline Up to 1930	9
2.1.1	The Lead-Up to 1900	9
2.1.2	The Gas Turbine Preparation Phase 1900–1930	21
2.2	Jet Web Timeline in Parallel 1931–1945	41
2.2.1	Turbomachinery and Aero-Related Activities Up to 1935	41
2.2.2	Early Turbojet Developments 1935–1939	45
2.2.3	The War Years 1940–1945	60
2.3	Gas Turbine/Turbojet Timeline for the Post-War Period 1946–1950	68
3	Excursion I: Max Koenig (1893–1975) and Claude Seippel (1900–1986)	71
4	Turbomachinery and Aero-Related Activities at BBC and in International Context up to 1935	87
4.1	Brown Boveri & Cie	88
4.1.1	The Founders and Their Works	88
4.1.2	Early Turbomachinery and Turbochargers	99
4.1.3	The Path from Aerofoil to First Axial Compressor	120
4.1.4	First Axial Turbo-Products and Wind Tunnel Blowers	131
4.2	A.A. Griffith and Early British Activities Towards Aero Gas Turbines	137
4.2.1	A ‘Scandal’ To Start With	137
4.2.2	Griffith’s Secret Reports of 1926 and 1929	141
4.2.3	Griffith and Whittle: A Patent Conflict?	149
4.3	Up To High Altitude: The German New Frontier	152
4.3.1	Thinking the Unthinkable: Poison Gas Bombing	157
4.3.2	The Altitude Aircraft Developments: From <i>Ju 49</i> To <i>Ju 86R</i>	163
4.3.3	The AVA Goettingen and The Axial-Flow Compressor	175

5	Excursion II: Fritz Heppner (1904–1982) and Hellmut Weinrich (1909–1988)	215
6	‘Connections’ and Early Turbo-Jet Developments 1935–1939	247
6.1	International Information Exchange/Transfer	247
6.1.1	The Dawning of a New Technical Age	247
6.1.2	Too Good to Be True	253
6.1.3	Berlin, 11–15 October 1938 Or: <i>Circus Lilienthal</i> At The Zoo Palace	263
6.1.4	Another Booklet and a Cartoon	275
6.2	Early Axial Turbojet Developments in Germany	281
6.2.1	Herbert Wagner and His Axial Engine Designs	287
6.2.2	Hans von Ohain, Going Radial at Heinkel	301
6.2.3	The RLM Turbojet Programme and Its Management	311
6.2.4	Initiating the <i>BMW 003</i> Turbojet	326
6.2.5	Start of the <i>Junkers Jumo 004</i> Turbojet Development	332
6.3	Early Turbojet Developments in Great Britain	336
6.3.1	Through Adversity to The Stars	336
6.3.2	The Emerging <i>Swiss Connection</i>	343
6.3.3	Royal Aircraft Establishment, Metrovick and Brown Boveri	356
6.3.4	The Power Gas Turbine Re-Insurance	367
6.3.5	London Calling	372
6.4	Early Turbojet Developments in the USA and Other Countries	380
6.4.1	Pioneering US Turbojets: A Difficult Delivery	380
6.4.2	BBC: At the Cradle of US Turbojets	384
6.4.3	The Aeronautical Impact of <i>Houdry</i> 100 Octane Fuel	394
6.4.4	G. Jendrassik and the First Turboprop Engine: From Hungary	397
7	Excursion III: Helmut Schelp (1912–1994) and Max Adolf Mueller (1901–1962)	401
7.1	Helmut Schelp’s Youth Up To 1935	402
7.2	The Making of a ‘ <i>Flugbaumeister</i> ’	409
7.3	Further Theoretical Work and Programme Structuring	431
7.4	Mauch and Schelp: At and Off RLM After 1939	436
7.5	The Talented, But Unsteady Max Adolf Mueller (1901–1962)	452
8	The War Years 1940–1945	465
8.1	German Turbojet Engine Developments and Related Activities	465
8.1.1	The <i>Junkers Jumo 109-004</i> Development and Production Programme	465
8.1.2	The <i>BMW 109-003</i> Development and Production Programme	495
8.1.3	The <i>Heinkel HeS 011</i> Development Programme	502

8.1.4 Summary of German Turbojet Engine Developments 513

8.2 British Turbojet Engine Developments 523

8.2.1 A *Phoney War* on Turbojet Propulsion 523

8.2.2 RAE: From Metrovick to Rolls-Royce and Armstrong
Siddeley 527

8.2.3 Alan Griffith at Rolls-Royce: A Mediocre Balance
Up To 1945 535

8.2.4 Fritz Heppner at ASM: The Rise and Fall of a German
Wunder-Engineer 541

8.3 BBC Aero Gas Turbine Activities and Derivatives 558

8.3.1 Brown Boveri: A Classic in Business Administration 559

8.3.2 Swiss Brown Boveri Turboprop Design Exercises 563

8.3.3 Altitude Test Facilities from Brown Boveri Mannheim 566

8.3.4 BBC Support to Tank Gas Turbines and an Aero
Derivative 571

8.3.5 Regenerated Aero Gas Turbine Developments 585

9 Excursion IV: Hermann Reuter (1911–1981) and Hermann Oestrich
(1903–1973) 593

9.1 Hermann Reuter, a Man of Hidden Qualities 594

9.2 Hermann Oestrich, a Clever Engineer, Always Ready in Time 608

9.3 Groupe O: *en marche* 619

9.4 ATAR: And Its Technology Ancestors 626

10 The Post-War Period 1946–1955 637

10.1 Great Britain: An Industrial Head Start, Still Going Radial 637

10.2 German Aeronautical Technology Transfer to the Allies 646

10.2.1 Building on German Achievements in the Soviet-Union 646

10.2.2 Building on German Achievements in the West 656

10.3 Switzerland: In Search of Its Post-War Possibilities 662

10.3.1 Swiss Turbojet Engine and Aircraft Awakening 662

10.3.2 BBC/C.E.M./SOCEMA: Going Aero 670

10.4 Hermann Oestrich: Taking Care of His People and Himself 675

11 Summary 679

12 Attachments 685

12.1 On Aero Propulsion Patents 1930–1950 685

12.1.1 Hans von Ohain’s Secret Turbojet Patents 685

12.1.2 Other Patents 698

12.2 Convention of the Lilienthal Society for Aeronautical Research e.V.,
Berlin 12–15 October 1938, List of Selected Participants 700

Bibliography 705

Index 729