"BERNHARDINE" PRINTER TIMELINE, BASED ON DOCUMENTS IN FILE NR. I.2.060C-02427 OF THE CORPORATE ARCHIVES AT DEUTSCHES TECHNIK MUSEUM BERLIN

EVENT DATE	EVENT	REF.	REF. DATE
Early 1935	 Idea to print the signals from the rotating beacon came from Mr Herbert Muth (TFK), as came the idea to use Hellschreiber for printing the signal-strength curve of the beacon transmissions.	204E	10-June-41
Dec-1935	The concept was demonstrated with a 1-channel ink strip-chart recorder. The experiments raised the problem that exactly when the bearing (azimuth) information was most needed, the antenna radiation pattern had a deep null.	204E	10-June-41
Jan-1936	The RLM orders 3 test installations. Printers: 2-channel wax paper strip chart recorders, custom made by Siemens M-Werk. Twin-lobe beam pointer transmission + 1-beam "Morse" encoded bearing.	204E	10-June-41
17-Mar-1936	This led to the invention by TFK/Lohmann of using a second, separate transmitter to send the bearing information [patent nr. 767354]  , with a special radiation pattern, and print that information as a separate trace, or on top of the signal with the null.	204E 204P	10-June-41 9-Feb-43
Spring 1937	• Valiation testing completed. • The RLM now requires easily readable & interpretable print-out, and no longer requires 0.1° accuracy. • TFK/Lohmann proposes transmitting bearing/azimuth in Hellschreiber format. • The method for print twin-peak signal strength curve with a Hellschreiber printer is still to be solved.	204E	10-June-41
Summer-Fall 1937	Hell Co. modifies a standard Hell Morse practice recorder, and builds a Hell printer amplifier  to superimpose sawtooth signal with duration equal to 1 revolution of the Hellschreiber printer spindle, to convert signal-strength to pulse width. Hell patents this method (patent nr. 730625). 	204E	10-June-41
11-Nov-1937	First flight test demo (to the RLM) with Hellschreiber beacon-printer.	204E 204F 204N	10-June-41 10-July-41 9-Feb-43
Fall 1937	The Printator company in Berlin provides a number of custom-sized Printator-foil strips to TFK.	204P	9-Feb-43
24-Nov-1937	• TFK/Lohmann mentions Printator tape idea to Rudolf Hell at the Hell Co. • TFK/Lohmann demonstrates Printator tape in a Hellschreiber printer (Hell's modified Morse practice recorder adapted to work with Printator tape.) at the Hell Co. lab. Tape is pulled through printer by hand. • Rudolf Hell confirms in writing to TFK having received request from TFK/Lohmann for a Printator-based Hellschreiber printer.	204J 204N 204P	12-Dec-42 9-Feb-43 9-Feb-43
Nov-1937 – Spring 1938	No development activity.		
Spring 1938	Decisions by TFK: • The beacon printer is to have 2x2 parallel printer traces, for simultaneous printing of two beacons (triangulation). • A beacon identifier letter is to be added to the bearing/azimuth Hellschreiber transmission. • Presentation of the printed paper tape to the operator has to be adapted to the conditions on-board the aircraft. The printing method was now finalized, with exception of the decision whether or not to use Printator tape.	204E	10-June-41
Summer 1938	No development activity, due to lack of resources at the Hell Co.	204E	10-June-41
Fall 1938	• First 4-channel Hellschreiber paper tape printer built by the Hell Co. Successful system tests. • Hell and TFK Navigation dept. decline to test Printator tape.	204E 204F	10-June-41 10-July-41

	• Demo to RLM of 4-channel receiver/printer system with 2 beacons.	204N	9-Feb-43
20-Oct-1938	TFK/Lehmpull has finished design drawings, and the first prototype Printator Hellschreiber [tape] printer has been built.	204J 204L	12-Oct-42 12-Dec-42
Winter 1938/39	Tests at TFK with the TFK prototype Printator Hellschreiber printer.	204N	9-Feb-43
Winter 1938/39	TFK/Lohmann has Hell's modified standard Morse practice recorder [from Nov-1937] adapted to work with Printator tape.	204E	10-June-41
11-March-1939	TFK/Lohmann apply for a patent for the Printator drum Hellschreiber printer (patent nr. 767513). 	204F 204J 204P	10-July-41 12-Oct-42 9-Feb-43
Spring 1939	• TFK/Lohmann demonstrates the Printator drum printer to Rudolf Hell. Hell still declines to develop a Printator printer, due to lack of resources and "other considerations". • TFK demonstrates tape Printator printer prototype to the RLM.	204E 204F 204J	10-June-41 10-July-41 12-Oct-42
Summer 1939 - Spring 1940	No development activity for one year due to outbreak of the war	204E	10-June-41
Spring 1940	The RLM suddenly issues contract to TFK for final development of the rotating beacon system [beacon ground station + airborne equipment with printer].	204E	10-June-41
1-March-1940	TFK and S&H [= TFK partner via AEG] decide that S&H will develop the Printator drum printer to production readiness, under contract to TFK	204F 204J 204N	10-July-41 12-Oct-42 9-Feb-43
Mid-April-1940 Spring 1940	TFK shows prototype Printator drum Hellschreiber printer prototype to S&H.	204F 204J 204N	10-July-41 12-Oct-42 9-Feb-43
May 1940	TFK discusses development of the required 2-channel audio filter and a Printator printer with S&H.	204E	10-June-41
15-May-1940	TFK provides design drawing of Printator disk Hellschreiber printer to S&H.	204F 204J 204N 204P	10-July-41 12-Oct-42 9-Feb-43 9-Feb-43
8-Oct-1940	TFK informs S&H that the airborne disk printer and associated 2-channel audio filter must now be developed with special RLM "Sonderstufe" priority, for testing as improved indicator instrument for the "Knickebein" beam system, as part of the airborne equipment system "Ulrich".	204A 204F	8-Oct-40 10-July-41
10-Oct-1940	• The RLM confirms the special "Sonderstufe" priority level. • TFK files for patent for Printator disk printer with built-in Printator foil separation knife blades  (patent nr. 767536), in addition to the 11-Mar-1939 patent filing (patent nr. 767513).	204N 204P	9-Feb-43 9-Feb-43
April/May-1941	The RLM orders 2000 Hellschreiber printers [→ HS 120] directly from the Hell Co.	204B	9-May-41
8-June-1941	TFK provides Printator printer amplifier and printer test equipment to Siemens & Halske (the tester several times throughout the month of June).	204E 204F 204J 204N 204P	10-June-41 10-July-41 12-Oct-42 9-Feb-43 9-Feb-43
June-1941	• Siemens built a Printator disk printer that meets TFK and RLM wishes [=Psch120a?].	204E	10-June-41
August-1941	• S&H receives contract from TFK for producing 2400 DFS120 Printator Peilschreiber Hellschreiber-printers [Psch120] for the TFK "Bernhardine" system. • At least the first 2000 of these are to be supplied to the RLM by TFK, with S&H as the manufacturer.	204J 204L 204K	12-Oct-42 12-Dec-42 8-Dec-42

TFK = Telefunken Gesell. mbH.
S&H = Siemens & Halske A.G.
RLM = Reichsluftfahrtministerium (Ministry of Aviation)