

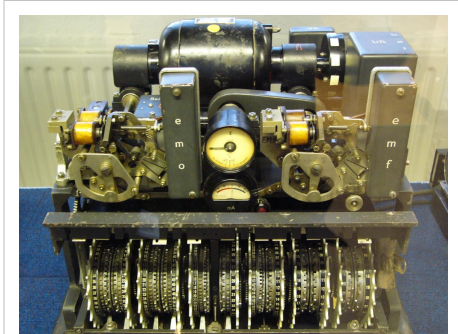
Lorenz-Schlüsselmaschine

Die **Lorenz-Schlüsselmaschine** (auch: *Lorenz-Schlüsselzusatz*), von den britischen Codeknackern in Bletchley Park „Tunny“ (deutsch: „Thunfisch“) genannt, diente zur geheimen Kommunikation mittels Fernschreibverbindungen. Sie wurde von der C. Lorenz AG, Berlin im Auftrag der deutschen Militärführung als Ergänzung zur Enigma-Schlüsselmaschine entwickelt, die mittels Morsecode verschlüsselte Nachrichten über Funkverbindungen übermittelte.

Fernschreiber können eine wesentlich höhere Datenrate übertragen, erfordern aber entweder eine Kabelverbindung oder eine stabile und störungsfreie Funkstrecke.

Die Deutschen wollten die maschinelle Verschlüsselung bequemer machen. Dazu wurde für einen Fernschreiber der Firma Lorenz ein Verschlüsselungszusatz entwickelt. Dieser Fernschreiber nutzte den üblichen Baudot-Murray-Code mit 5 Bit für die Übertragung von 32 Zeichen. Die Binärdarstellung eignet sich besonders gut für die modulare Addition eines zufälligen Schlüssels (siehe auch: One-Time-Pad):

Geheimtext = Klartext XOR Schlüssel



Lorenz SZ42

Die deutschen Entwickler nannten das neue Gerät nach seinem Schlüsselzusatz Lorenz SZ40 (Folgemodelle SZ42 und SZ42a). Der entscheidende Vorteil dieses Systems lag darin, dass man auf der Senderseite Klartext eingab, der dann auf der Empfängerseite wieder als Klartext ausgegeben wurde. Das System war jedoch zu schwer und zu groß, um die Enigma zu ersetzen. Die Lorenz wurde deshalb nur für den Funkverkehr höherer Stellen eingesetzt.

Die Lorenz SZ42 benutzte 12 Rotoren (Walzen) mit unregelmäßig verteilten Stiften. Die erste Gruppe der fünf Stiftwalzen mit der 41-, 31-, 29-, 26-, 23- Teilung steuerte Vernam-Substitutionen des 5-Bit-Codes. Jede Walze wurde für jedes Zeichen um einen Schritt fortgeschaltet. Die zweite Fünfer-Gruppe mit der 43-, 47-, 51-, 53- und 59-Teilung wurde der ersten Gruppe mit Vernam-Schritten nachgeschaltet. Zwei weitere Walzen dienten lediglich der unregelmäßigen Fortschaltung. Die Walze mit der Periode 61 bewegte die erste Walzengruppe und steuerte die zweite Walze mit der Periode 37, welche die zweite Walzengruppe steuerte. Sämtliche Walzen konnten beliebig mit Stiften versehen werden. Die einstellbare Anfangsstellung der Walzen ermöglichte einen individuellen Spruchschlüssel. Der Schlüssel hat eine Periode von mehr als 10^{19} .

Die Entzifferung der Lorenz-Chiffre

Auf der seit 1941 bestehenden Funkstrecke Wien-Athen der Wehrmacht wurde noch während der Erprobung eine etwa viertausend Zeichen lange Nachricht, nur leicht verschoben, zweimal mit derselben Anfangsstellung der «Schlüsselräder» ausgesandt, also mit demselben Schlüssel chiffriert. Der Empfänger hatte den Sender aufgefordert, die Nachricht neu zu senden, wobei das am Anfang stehende Wort "SPRUCHNUMMER" durch "SPRUCHNR" ersetzt wurde. Dieser schwere Fehler eines deutschen Nachrichtensoldaten sofort bei Einführung sollte entscheidend für die Entzifferung der Lorenz-Chiffre werden.

Der Chiffrierferschreiber T52 („Geheimschreiber“) von Siemens war in einem Patent offen beschrieben und den Briten bekannt (Codename „FISH“). Diese Maschine arbeitete ähnlich der Lorenz-Maschine. John Tiltman, Chef des britischen Dechiffrierwesens in Bletchley Park, konnte in wochenlanger Handarbeit die Klartexte ermitteln. Von den beiden aufgefangenen Sprüchen bildete er die Differenz und versuchte, wahrscheinliche Worte einzusetzen. Dadurch gelang es, ein viertausend Zeichen langes Teilstück des Schlüssels und letztendlich die innere Struktur der SZ42 zu rekonstruieren.

Der junge Mathematiker William Thomas Tutte fand die Anzahl und die Perioden der einzelnen Schlüsselräder heraus. Im Januar 1942 war die gesamte Struktur aufgeklärt, einschließlich der Lage der Schaltstifte auf den Schlüsselrädern. Man musste jeweils „nur“ noch die richtige Anfangsstellung der Schlüsselräder herausfinden. Das Knacken des Codes per Hand dauerte 1943 normalerweise etwa vier Tage. Bis dahin waren die Meldungen unter Umständen veraltet. Deshalb versuchte man, das Verfahren zu mechanisieren.

Die Maschine, die dies bewerkstelligen konnte, war die Colossus, die ab Februar 1944 erfolgreich gegen die SZ42 eingesetzt wurde.

Literatur

- Klaus Schmeh: *Codeknacker gegen Codemacher. Die faszinierende Geschichte der Verschlüsselung*. 2. Auflage. W3L-Verlag, Herdecke u. a. 2008, ISBN 978-3-937137-89-6.
- Bengt Beckmann, K.O.Widmann: *Arne Beurling und Hitlers Geheimschreiber*. Springer, Berlin 2005, ISBN 3-540-23720-8.

Weblinks

- <http://www.codesandciphers.org.uk/lorenz/fish.htm> - Foto einer Lorenz-Maschine, zu besichtigen in Bletchley Park (en)
- http://www.alanturing.net/turing_archive/archive/index/codebreakingindex.html - Originaldokumente aus dem 2. Weltkrieg zu „Tunny“, der britischen Fassung der Lorenz-Maschine, und Colossus (en)

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