Forty years of FSG and Fortran Standards

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## Early years of Fortran: 1954-1961

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954</td>
<td>Development work starts in IBM</td>
</tr>
<tr>
<td>1957</td>
<td>IBM release a Fortran compiler for the IBM 704</td>
</tr>
<tr>
<td>1958</td>
<td>IBM release Fortran II, with subroutines and blank common</td>
</tr>
<tr>
<td>1960</td>
<td>Philco release ALTAC, a Fortran II look-alike</td>
</tr>
<tr>
<td>1961</td>
<td>IBM have eight different compilers (for the 709, 650, 1620 and 7090) and publish a guide to language variations between them</td>
</tr>
<tr>
<td>1961</td>
<td>Univac release Fortran I for the SS80, the first compiler called ‘Fortran’ for a non-IBM machine</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
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</tr>
<tr>
<td>1962</td>
<td>Work on an ASA standard begins in order to promote consistency and enable portability.</td>
</tr>
<tr>
<td>1962</td>
<td>IBM release Fortran IV for the 7030, 7090 and 7094; this removes some of the machine dependencies.</td>
</tr>
<tr>
<td>1963</td>
<td>Most major US vendors have Fortran systems, either Fortran II or, increasingly, Fortran IV.</td>
</tr>
<tr>
<td>1964</td>
<td>Technical work on the standard is complete. It is essentially a common subset of vendors’ offerings.</td>
</tr>
<tr>
<td>1965</td>
<td>ICT have Fortran IV on the 1900 and English Electric have Egtran on the KDF9.</td>
</tr>
</tbody>
</table>
The first US Standard X3.9-1966
The Fortran Specialist Group is established: 1970

FSG Minutes of 6 January 1970:

The objectives of the group were formally agreed to be:

(a) to form a focus in the United Kingdom for work concerned with establishing and maintaining FORTRAN standards.

(b) to work in association with national and international standardisation bodies.

FSG Minutes of 5 April 1976:

4. Revision of objectives

Following further discussion, the wording of the proposed revised objectives now becomes "To undertake activities associated with any aspects of Fortran".

It is intended to present this for approval at the next Specialist Groups meeting.

January 1970
Analyse existing standard
Comparison of existing compilers
Extension to Fortran

April 1970
Extensions to ASI Fortran IV
Adaptation to conversational use
Fortran on small machines

April 1971
Free format
Mini computers
Diagnostics
Extensions

1975
FORTREV (draft Fortran 77) review

April 1976
Preprocessors
Group Promotion & Information

December 1976
Review Codasyl FDBMLC JOD
FSG Activities 1970-1980

- FSG hold typically four to six meetings per year, mostly discussing working party progress, applications, software tools, programming techniques and, from late 1971, Fortran standards developments
- First contact with X3J3 members 1971
- FSG get on X3J3 mailing list and two-way flow of information and opinion starts
- FSG members attend occasional X3J3 meetings in the US
- Presentations are made at conferences and workshops, e.g. Datafair 73, 75 and 77 and a Fortran Forum in London in 1978 with six US members of X3J3 as speakers
FSG Review of draft Fortran 77

- In 1976 the FSG buy 50 copies of the draft Fortran 77 standard published by the ACM for distribution to members and to the general public
- Comments are relayed back to the US Fortran committee
- On completion of the technical work, FSG nominate Frank Engel, chairman of the US Fortran committee for honorary fellowship of the BCS
Fortran 77: Principal changes

type CHARACTER
IMPLICIT, PARAMETER, SAVE
block IF
ENTRY
INQUIRE
new intrinsic functions
many detailed extensions to existing statements
real and double precision DO index
removal of Hollerith constants and data
The second US Standard X3.9-1978
(Fortran 77)
IMPLICIT NONE
INCLUDE
END DO
DO WHILE
Additional functions for bit manipulation
Programming Language Standardization up to late 1970s

US: Cobol, Fortran, PL/I
UK: Coral, Pascal, RTL/2
Germany: Pearl
IFIP: Algol 60

US, UK, Japan, ECMA were all independently standardizing Basic!

Major disadvantage 1: national standards could be adopted as ISO standards without many of their eventual users having had opportunity to specify their interests or requirements

Major disadvantage 2: nothing to prevent conflicting standards
# Internationalization in ISO

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<td>1977</td>
<td>‘The Hague Agreement’: Countries agree to closer international collaboration on development of programming language standards.</td>
</tr>
<tr>
<td>1978</td>
<td>First meeting of ISO Fortran Experts Group, in London. 36 individuals from seven countries attend</td>
</tr>
<tr>
<td>1980</td>
<td>The US Fortran 77 standard is re-issued as ISO 1539</td>
</tr>
<tr>
<td>1983</td>
<td>After annual formal meetings or short ad hoc meetings at SC5 plenaries, the Fortran group is established as a formal ISO Working Group</td>
</tr>
<tr>
<td>1985</td>
<td>X3J3 start holding occasional meetings outside the US – Oxford, Halifax NS, Liverpool, Vienna, …</td>
</tr>
<tr>
<td>1985</td>
<td>The ISO Fortran group is renamed SC22/WG5 and is formally required to ‘coordinate’ revision of the Fortran standard</td>
</tr>
</tbody>
</table>
FSG Activities 1981-1993

- FSG thrives, continuing in the same mode
- Fortran Forums are held in London (4) and Edinburgh (2), sometimes with visiting US speakers
- Some meetings are held outside London: Blacknest, Coventry, Jodrell Bank, Oxford, Reading, Rutherford Lab, Salford
- An experimental subgroup meeting is held in Glasgow as part of a drive for every Specialist Group to have meetings in Scotland
- Some FSG members become members of X3J3 and/or WG5 and attend regularly; others attend occasionally; the UK plays a significant part in development of Fortran 90
Development of Fortran 90

- Originally scheduled for completion in 1982
- Renamed Fortran 8X, then Fortran 88 and finally completed in 1990 after rancorous discussions and attempts by some US vendors to derail the entire project
- Some US organizations attempt to retain Fortran 77 alongside Fortran 90
- See “The Fortran (not the foresight) saga: the light and the dark” by Brian Meek and “The Standards Hiatus” by Miles Ellis and Lawrie Schonfelder both linked from http://www.fortran.bcs.org/2007/jubileeprog.php
Fortran 90: Principal changes

- Free form source
- Many minor modernizations and removal of arbitrary restrictions
- Array operations
- Facilities for modular data and procedure definitions
- Improved control over numerical computation
- Parameterized intrinsic types
- User-defined data types
- Pointers
- Some features deemed obsolescent – to allow for future deletion
- **Still retaining compatibility for Fortran 77 programs!!**
First Fortran 90 Compiler

- NAG announce the world’s first Fortran 90 compiler in June 1991

- The FSG nominate NAG for a BCS Excellence award; NAG are awarded a BCS medal
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<tr>
<td>1989</td>
<td>Formal request to ISO to initiate project</td>
</tr>
<tr>
<td>1990</td>
<td>First draft</td>
</tr>
<tr>
<td>1994</td>
<td>Published as ISO/IEC 1539-2:1994</td>
</tr>
<tr>
<td>2000</td>
<td>Revision, to take advantage of new features in Fortran 95, published as ISO/IEC 1539-2:2000</td>
</tr>
<tr>
<td>201x</td>
<td>Expected to be withdrawn when Fortran 2008 is published</td>
</tr>
</tbody>
</table>
Fortran 95: Principal changes

Part 1:

- FORALL
- PURE and ELEMENTAL procedures
- Initialization for pointers and for structures
- Designation of some older, duplicated features as ‘obsolescent’
- Deletion of real and DP DO variables, PAUSE, ASSIGN and assigned GO TO, H edit descriptor

Part 2:

- Varying length strings
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<td>1995</td>
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</tr>
<tr>
<td>1996</td>
<td>Formal request to ISO to initiate project</td>
</tr>
<tr>
<td>1999</td>
<td>Published as ISO/IEC 1539-3:1999 (with one line inadvertently omitted)</td>
</tr>
<tr>
<td>2000</td>
<td>A number of desirable clarifications are identified and are designated to appear in the first corrigendum. This is never published due to lack of interest</td>
</tr>
<tr>
<td>2010</td>
<td>The standard is currently being voted on for retention or deletion (the latter being more likely)</td>
</tr>
</tbody>
</table>
FSG Activities 1993-2001

- Attendances wilt with the advent of the internet
- The FSG debates winding itself up but decides against
- In 1994, taking advantage of X3J3 and WG5 meetings in the UK, well-attended forums are held in Edinburgh, London and Oxford – but:
  - a nadir is reached when the 1995 AGM is postponed because of a rail strike and the 1996 AGM is postponed due to rooms being double-booked; not everyone gets to know in time
- It is decided to hold only annual meetings plus special events
- NAG hold very successful ‘Fortran Futures 96’ and ‘Fortran Futures 98’ conferences “in association with the FSG”
Fortran 2003: Principal changes

- Parameterized derived types
- Object oriented programming support
- I/O enhancements, including stream access and asynchronous transfers
- Support for IEEE arithmetic and exception handling
- Interoperability with C
- Support for ‘international usage’
- ASSOCIATE construct
- Data manipulation enhancements: allocatable components, etc
- Procedure pointers
- Scoping enhancements
- Access to command line arguments, etc
Fortran 2003: Implementation Problems

- Fortran 2003 turns out to be far more difficult to implement than had been foreseen.
- Cray release the first full compiler, for some of their hardware, in December 2009 - six years after completion of the technical definition.
- In 2010 IBM are the second vendor to release a full compiler.
- Some suppliers let it be known that they plan to implement all of Fortran 2003 only if explicitly required by their customers.
Technical Reports

Current:

In development:
PDTR 29113   Further Interoperability of Fortran with C

Withdrawn:
ISO/IEC TR 15580:2001   Floating-point exception handling
ISO/IEC TR 15581:2001   Fortran -- Enhanced data type facilities

Development re-incorporated into base standard:
PDTR 15815   Interoperability with C - started April 1995, reassigned to X3J3 July 1997
Technical Corrigenda

Technical corrigenda correct errors and specify edits for clarifications in an existing standard.

ISO have published corrigenda for Fortran 2003 annually, price CHF 0,00, from 2006 to 2009. A 2010 edition was prepared but could not be published because of the impending formal redundancy of the standard. It is on the WG5 website.

A combined set of the five corrigenda is also on the WG5 website as N1823.
Requirements collection procedure

National member of ISO → National member of ISO → National member of ISO → ....

WG5 repository of requirements

WG5 decide on adoption of content

Final set of requirements to be implemented by a development body (always X3J3 in practice)
<table>
<thead>
<tr>
<th>Date Range</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004 May</td>
<td>Repository of requirements started</td>
</tr>
<tr>
<td>2005 May - 2006 Feb</td>
<td>Choice of significant features</td>
</tr>
<tr>
<td>2007 Dec</td>
<td>First working draft of revised standard</td>
</tr>
<tr>
<td>2008 May</td>
<td>Document submitted for Committee Draft ballot</td>
</tr>
<tr>
<td>2008 Oct</td>
<td>Comments available</td>
</tr>
<tr>
<td>2009 Jul - 2009 Dec</td>
<td>Final Committee Draft submission and ballot</td>
</tr>
<tr>
<td>2010 Jul</td>
<td>FDIS ballot results available</td>
</tr>
<tr>
<td>2010 Aug</td>
<td>Standard published</td>
</tr>
</tbody>
</table>
The FSG is revivified:

- In 2002 a Forum is held to discuss UK requirements for revision of Fortran 2003
- Also in 2002 a successful application is made to the BCS to support three FSG members (reduced to one member latterly) to attend WG5 meetings to help put the UK case on standards
- In 2007 a very successful full-day meeting is held to mark the 50th anniversary of the release of the first Fortran compiler
- FSG members organize the 2007 WG5 meeting in BCS London offices and hold a reception for WG5 members
Further Information

FSG website
http://www.fortran.bcs.org/index.php

WG5 document archive
http://www.nag.co.uk/sc22wg5/

J3 document archive
http://www.j3-fortran.org/

Fortran and Fortran II history, including 1982 IBM film
http://www.softwarepreservation.org/projects/FORTRAN/