ANS X3.9 Fortran Revision – Final Report

Frank Engel, Chairman

American National Standards Institute Technical Committee X3J3 completed work on the revised American National Standard X3.9 Fortran [Fortran 77] in accordance with established procedures. By a nearly unanimous vote of 28 to 1, X3J3 recommends that X3 proceed with the final processing of the amended [Board of Standards Review] BSR 13.9 Fortran, document X3d3/90, as the ANS X3.9 Fortran (revised). Upon final approval, this document will supersede ANS X3.9-1966 Fortran [Fortran 66] and will provide definitions for both the Fortran language and the subset Fortran language. X3J3 also recommends that the ANS X3.10-1966 Basic Fortran be withdrawn.

A previous report, document X3/75-99, presented to X3 in October, 1975, described in detail the work of X3J3 in preparing the dpANS X3.9 Fortran document X3J3/75. This supplementary report covers the activities of X3J3 from December,, 1975 to the present, and includes the preparation and publication of BSR X3.9 Fortran (X3J3/76) for public review and comment, the processing of the public comments and responses, and the repair of document X3J3/76 that resulted from consideration of the public comments.

Publication of dpANS X3.9 Fortran

Following X3J3 letter ballot approval for submittal for further processing and X3 approval for publication for public review, the dpANS X3.9 Fortran full language and its subset was published as the March, 1976 issue of the ACM SIGPLan Notices, Vol.11, No.3. Of the initial printing of 8000 copies, 6000 went to SIGPLan members throughout the world; 400 copies were purchased by NBS for federal government use; 200 copies were distributed by CBEMA, including 85 sent to the

International Standards Association; 100 copies were sold to Fortran Forum attendees; and 50 copies were purchased by the British Computer Society Fortran Specialists Group (BCS/FSG) for distribution in England. ACM reported this to be one of their most active publications, and that a second printing was necessary to meet the demand. Thus there have been over 8000 copies of the BSR X3.9 Fortran document distributed. In contrast, the COBOL document BSR X3.23 had a printing of 2000 copies, 1000 of which were purchased by a single vendor, 100 by the federal government, and 500 by the general public; and the PL/1 document BSR X3.53 had a printing of 1000 copies, 300 going to the federal government and 400 to the general public. The price of the BSR X3.9 Fortran document was $5.00 per copy, while the COBOL and PL/1 documents sold for $6.00 and $8.00, respectively.

The document, including the cover, was printed from photo-ready copy prepared by J. Crawford Noll of Bell Telephone Laboratories, using automated text editing facilities that were available to X3J3 in the development of the draft proposed standard. The publication format featured a side-by-side presentation of the full Fortran language and the subset in a section by section alinement. The BSR X3.9 comprises 18 sections, six appendices, a table of contents and an index for a total of 200 pages.

Informing the Public

At the instigation of X3J3 two special meetings were organized to discuss the BSR X3.9 Fortran. The West Coast Fortran Forum sponsored by the Los Angeles Chapters of the ACM and SIGPLan was held in Anaheim preceding the Computer Science Conference in February 1976, and the ACM SIGPLan Fortran Forum III was held at the National Bureau of Standards in Gaithersburg in March, 1976. Both forums were co-sponsored by NBS, and programs featured X3J3 members giving presentations on various aspects of the proposed revision of the Fortran standard. Each forum was attended by over 200 persons who enthusiastically responded favorably to the proposed standard.

X3J3 members have made presentations on the proposed standard at other national meetings including the 1976 National Computer Conference, the 1976 ACM National Conference and the major user groups, and at local meetings such as ACM chapters and university colloquia. They have also discussed the proposed standard at international meetings including ECMA/TC8, SEAS, the BCS/FSG, the Purdue Workshop Fortran Committee and the IFIP Working Group 2.5 on Numerical Software.

Public Review and Comment Processing

The public review period began March l, 1976 with the publication of the SIG-PLan Notices; however, due to administrative anomalies beyond the control of X3J3 the formal official ANSI announcement was delayed, and the closing date of the public review period was extended by X3 from July 4, as originally stated in the published document, to September 28, 1976. Thus, the document was available for seven months for review by the general public.

The wide distribution and discussion of the document resulted in a large number of comments. Some 289 individual s and organizations submitted 1225 pages of comments, citing 2397 items to the attention of the committee. While many of the comment letters cited only one item (most notably the fifty-three that ignored everything, except the IF-THEN-ELSE proposal that had been publicized in FORWORD), there were a substantial number that cited more than twenty to thirty items each. Many letters indicated a very careful review and understanding of the document by the authors, and a sincere concern for the development of the Fortran language. The comments were overwhelmingly favorable and complimentary of the committee's efforts in revising the Fortran language standard, as exemplified by the following quotation from C143:

> "… Despite the extent of these comments and suggestions, my overall reaction is favorable and I would recommend its (BSR X3.9) adoption, even if none of my suggestions is acted upon…. Let me compliment X3J3 on a job well done." Then, after 60 pages of 74 comment items, he concluded with: "The proposed standard is such an improvement over the 1966 standard that I cannot wholeheartedly support any proposal, however valuable, which may delay its adoption."

A summary and analysis of the public comments is given in Attachment A. Some of the comments, anticipating the continued enthusiasm and interest in Fortran that will result from the adoption of this proposed standard, offered suggestions for inclusion in the *next* revision of the standard. Others suggested that new features be included in this current revision, or that some of the features be modified or deleted from the current revision. The comment items were distributed among several categories as follows:

Addition of new features 40%

Modifications to existing features 16%

Deletion of features 6%

Textual clarity, style, etc. 27%

Clarification & interpretation 6%

Misunderstanding 2%

The very few adverse comments received fell into several categories:

1. "Fortran is an ill-structured language and should not be extended." – C213.2

2 "It fails utterly to correct any of the manifest failings of Fortran." – C 213.16

3 "The standards committee does a disservice by removing such features" that invalidate existing standard conforming programs. – C25

4 "The proposal does not go far enough …" – C213.4, C218

5 The proposed standard goes too far. "The committee should not do development work." – C282

With the exception of the first critique, these represent diametrically opposing views that are impossible to satisfy simultaneously. The amended BSR X3.9 Fortran represents a good compromise between the extreme positions, between modest growth and development of the standard Fortran language and the state-of-the-art that is consistent with the criteria X3J3 established to govern this revision (cf X3/75-99). The first criticism likewise cannot be satisfied by any repair of the document. For everyone holding this position there are hundreds – perhaps even thousands – who feel that a new Fortran standard is needed.

At its July, 1976 meeting X3J3 began processing the comments. As each letter was received the X3J3 Secretary assigned it a sequence number, identified each separate item discussed in the letter, and assigned responsibility for each item to one of seven X3J3 working groups. The annotation C149.8-2 identifies the eighth item of comment letter C 149, for which working group 2 had cognizance. The annotated comment letters were distributed to the committee members as working document X3J3/81, with an index and cross reference list of group assignments by comment item and author. The members assigned to the seven working groups and the sections of the proposed standard for which each group was responsible are given Appendix E of the Minutes of the 54th and subsequent meetings.

The working group prepared an appropriate response to each comment item that was assigned to it. When a change to the BSR X3.9 document was deemed necessary by the working group, the group prepared and submitted a proposal for consideration by the full committee, together with the textual modifications recommended by the group to effect the change. The individual comment responses, containing a list of the comment items to which each applied, were distributed to each X3J3 member in working document X3J3/82. Any member could raise ob-

jection to a response and call for full committee consideration of any group response. Using text editing facilities provided by Tom Gibson and Bruce Puerling of Bell Telephone Laboratories, X3J3/8? was reissued as working document X3J3/82.1 in which the responses were reordered and arranged by comment letter and item number, instead of the response number organization employed in /82. Prior to the May, 1977 X3J3 meeting, each comment letter and its responses were assigned to at least three X3J3 members for an independent review and critique as to the relevance and adequacy of the response to each item. At the May, 1977 meeting the full committee then considered the results of the members' critiques, and approved the set of responses, as appropriately modified, that is contained in document X3J3/91.

For the record, documents X3J3/81 and /91 are transmitted herewith, and they may be examined by anyone desiring so to do. Presumably arrangements may be made with the X3 Secretariat, should anyone require copies of these voluminous documents for himself. X3J3 is sending to each commenter a copy of his annotated letter from X3J3/81 and the set of responses to his comments from X3J3/91.

Repair and Modification of the BSR X 3.9 Document

In considering the proposals arising from the public comments, X3J3 was reluctant to make any changes to the BSR X3.9 Fortran document. In particular, the committee wished to avoid any drastic changes that might necessitate another extended public review and further delay the promulgation of this overdue revision. Thus, a major reorganization and rewriting of certain sections was rejected, as was any change in style or formalism of syntactic description. Changes that corrected errors and misstatements or improved the clarity of the text were considered to be mandatory. The committee also recognized the desirability of modifying or removing syntactic forms that might inhibit the future development of the Fortran language as suggested by the public comments and/or that would improve program portability. Each proposed change to the BSR X3.9 Fortran document, whether editorial or substantive, was acted upon by the full committee at one of the nine meetings held since December, 1975. Most of the proposals were put forward by the working groups or by the editor, and a small number were offered independently by individual X3J3 members. Over 500 motions to change the document were considered, with 83% being approved, 14% rejected and 3% tabled without a deciding vote, these motions and proposals are fully documented in the several minutes of X3J3 meetings.

With respect to the several categories of the public comment items, the committee actions were as follows:

Addition of new features: 18% accepted

Modifications to existing features: 46% accepted

Deletion of features: 21% accepted

Textual cl arity, style, etc. 56% accepted

It would be noted that in rejecting a new feature for inclusion in this revision, X3J3 was not necessarily opposed to the feature as a part of the Fortran language, but the committee was deferring the feature until the next revision, rather than delay the promulgation of this revision. The committee had previously considered most of these items at one time or another and failed to complete the work necessary for their adoption. For some items more time is needed to develop a consensus, and experience to be gained with the implementation and use of this revision will be helpful in determining that consensus. Other items require much work and time to incorporate them into the document, and the interactive effects of such extensive changes militates against their being undertaken at this stage of the revision process. Similarly, in refusing to delete a feature from the language at this time, the committee was not precluding that from being done at some future time when another revision is undertaken.

Attachment B is a summary of the X3J3 actions with respect to substantive issues affecting the language features that arose from the consideration of the public comments. In addition to those actions that resulted in changes from X3J3/76, (BSR X3.9) document, Attachment B also includes a list of X3d3 actions that rejected proposed modifications and affirmed the features as described in X3J3/76. Finally, Attachment B contains a list of the major differences in the revised ANS X3.9 Fortran, X3J3/90 from the ANS X3.9-1966 Fortran that it replaces.

Informing the Public – Continued

During the year since the BSR Fortran document was published and the initial public review, X3J3 has striven to keep the public informed of its actions. The current X3J.3 mailing list contains 240 addresses. Included in the mailing list are representatives of ECMA/TC8 and the British, Danish, Dutch, French, Japanese and Swedish national standards bodies. They have received notices of X3J3 meetings and the complete minutes of those meetings, which as noted above, fully document the committee' s actions. Of the eight interim revisions to X3J3/76 that have been prepared as working documents of the committee, four have been distributed to the full mail ing list, including X3J3/76. 7 which includes al l substantive revisions. Following each X3J3 meeting, a committee approved press release was issued announcing the significant actions that had been taken.

An X3d3 member, Dr. Loren Meissner of the University of California Lawrence Berkeley Laboratories, is Editor of FOR-WORD, a newsletter published by the Fortran Development Committee of the ACM SIGPLan. The FOR-WORD distribution includes the entire X3J3 mailing list, every comment letter author, and every Fortran Forum attendee, among others interested in Fortran. Summaries of the changes to X3Ö3/76 that were approved by X3J3 have been regularly published in FOR-WORD by Dr. Meissner. These summaries also appeared in SIG-PLan Notices in January, and April, 1977.

There has been an ongoing dialogue with the general public through continued correspondence and in person. Twenty-nine visitors have attended the nine X3J3 meetings and have interacted directly with the committee Following the Fortran Forums, X3J3 members met with interested attendees discussing the proposed standard and exchanging ideas about the language development. X3J3 members recently attended the BCS/FSG and ECMA/TC8 meetings to discuss the final amended BSR X3.9 Fortran. Representatives of those groups have attended X3J3 meetings, and Mr. Watson of JCL has become a member of X3J3 representing ECMA/TC8.

The reply to each comment letter in addition to the responses to each item per X3J3/91, will also include a copy of Attachment B, so that the author will be informed of all of the changes accepted and rejected by the committee, and not just the committee's reaction to those items mentioned in his own letter.

Administrative Summary

X3/75-99 reported on the X3J3 meetings, membership participation and sponsor representation through October, 1975. Since that time there have been nine more committee meetings and further changes in the membership. Of the six members who then had served for eight years from the inception of the clarification and revision work in 1967, there remain four who now have completed ten years of active service with the committee. Due to reassignment of responsibilities within their sponsoring organizations, Carl Bailey of Sandia Corporation and Ward Klein of IBM have withdrawn from membership. Martin Greenfield of Honeywell Information Systems is vice chairman of X3J3 and was a member of ASA X3.4.3 committee and participated actively in the development of the 1966 standards. Lloyd Campbell of the U. S. Amy Ballistics Research Laboratory is secretary of X3J3, and as editor has been personally responsible for the consistency of style, grammar, etc. apparent in the document. Betty Holberton of the NBS and the writer are the other long standing members still on the committee, and together these four account for over twenty percent of the total meeting man years that have

gone into the preparation of the document. There has been a slight reduction in representation of producers for small dp systems, and an increase in the participation by both government and general users of the Fortran language. These are reflected in the data of Table 1, which includes the information reported previously in X3/75-99.

TABLE 1: X3J3 MEETING SUMMARY

Year	Sponsor Representation				Avg. No. of V. M.*	No. of Meetings	Avg. Days/ Mgt.	Avg. Atten- dance	Mtg. Man- days**
	Producers		Users						
	Large	Small	Gen'l	Gov't					
1967	5	0	3	2	10	5	1	10	65
1968	6	0	5	2	12	5	2	9	90
1969	6	0	9	3	12	6	3	17	306
1970	6	0	10	3	21	6	3	18	324
1971	7	0	10	3	23	6	3	20	360
1972	6	2	13	6	24	6	3	22	396
1973	7	3	13	5	23	6	4	23	552
1974	7	5	9	4	27	6	4	23	552
1975	7	6	9	3	25	8	5	21	725
1976	7	4	9	5	25	5	4	21	399
1977	7	3	12	6	28	3	5	25	358***

*   Voting Member
** Meeting-Man-Days   ***This Table includes Through May 1977

Since October, 1975, X3J3 members expended 852 meeting man days in completing its letter ballot responses, preparing X3J3/76 for publication as BSR X3.9 Fortran, considering comments, preparing and approving comment responses, and repairing the document for submission for final approval as the ANS X3.9 Fortran. Thus, the total effort invested in producing the amended document which we now submit for your approval is at least 33 man years, 6.8 man years representing the latter period covered by this report. As suggested in X3/75-,99, this represents an expenditure in excess of two million dollars. The text editing resource, document preparation and distribution represents an additional expenditure in excess of $100,000.

Future Projections

There is a strong consensus in X3J3 that the amended BSR X3.9 Fortran is a good and sound base upon which future Fortran standard developments can take place in whatever direction they may go. With the cooperation of X3 and ANSI, these events will take place:

June 1977: X3 acceptance of our recommendation to proceed with the final processing of the revised standard

July to September 1977: The 60-day X3 letter ballot for final approval and concurrent public review period

October 1977: X3J3 consider and respond to those issues that may arise from the letter ballot and final public review, if any

November 1977: Publication of ANS X3.9-1977 Fortran

November 1977: International Standards Organization TC97/SC5 Fortran working group having requested and received document X3J3/90, meeting to consider its adoption as revision of ISO R-1539 Fortran. The AFNOR organization has begun the translation of BSR X3.9 into French, and has requested that no more changes be made

November 1980: X3J3 publication of dpANS X3.9 Fortran for the next revision use

November 1982: Publication of ANS X3.9-1982 Fortran

From the consideration of the public comments on BSR X3.9 Fortran, it is apparent that another revision of the standard should be anticipated. The latest date for it to appear should be November 1982, if the five year ANSI review cycle is honored, and the current revision is issued in November 1977 as postulated. Assuming that two years will be required for publication, public review and comment, and final processing (as occurred this time), then the draft proposed next revision document should be completed in November, 1980. That being scarcely three years away, it is essential that X3J3 immediately initiate the preparation of that document.

In October, 1975, I appointed a subcommittee on future revisions, and directed that it:

Develop suitable criteria to determine whether or not another revision of ANS X3.9 is necessary and desirable

Develop suitable objectives for a future revision of ANS X3e9

Develop suitable criteria for acceptance or rejection of proposed changes to the language

Determine how the language can best adapt to future needs and divers requirements to collect and classify candidate features for a future revision

Because of the ongoing work on the current revision and the demands on X3J3 resources to respond to the public comments, this subcommittee will hold its first meeting in July. It will draft the SD-3 document proposing that a project be established to. prepare a draft proposed revision of ANS X3.9-1977 Fortran for release for public review and comment in 1980. It has taken two years to change the attitude of X3J3 members from trying to get one more new feature into this revision, to focusing on the next revision as the proper time to make other needed extensions to the language. A not insignificant contributing factor in this transition has been sponsor pressure to terminate this project that has extended over ten years. Sponsors, too, have been looking at the cost in individual terms, and have set limits for their continued participation.

The alternative to this projected schedule of events, should further repair of BSR X3.9 Fortran be contemplated, is not at all attractive, unless one's objective is to forestall the continued popularity of Fortran. To amend this document again would mean at least another two years' delay in its final adoption, inasmuch as that is the time it takes to go through the cycle of repair, publish, respond, vote, etc. Opening up for reconsideration, with the anticipated change in X3J3 membership, will most certainly result in changes to the language, not all of which will be those desired by the dissenting voices. Such changes made under the duress of a short "review and repair" cycle can only degrade the document, as a standard, rather than improve it. However, in terms of the time frame, this amended, inferior document would appear in November 1979, just one year before the draft proposed ANS X3.9 for the following revision will appear, according to our projected schedule of events. There is no assurance that the amended amended document will be any more acceptable to all who then ballot. Could it be that the cycle would repeat again, and again, and …?

There are strong indications that the world will not wait another two years for an acceptable Fortran standard. BSR X3.9 Fortran, either in the published version of X3J3/76 or the amended version of X3J3/90 may very well become the de facto standard without becoming the "approved" ANSI standard. We are aware of at least two existing implementations for significant systems that profess to be "Fortran 77 conforming processors," and there are indications that most producers are well along with implementations of such processors for their systems. There have been rumors that there is pressure for the federal government to adopt a federal standard for Fortran; If there is not an ANSI standard adopted now, then that federal standard would be the BSR X3.9 Fortran. We believe that a further delay

in adopting the revised Fortran standard will not be in the best interests of standardization, but will encourage the proliferation of those practices that standardization is intended to avoid.

Conclusion

The American National Standards Institute Technical Committee X3J3 has fully and responsibly discharged its obligations:

To produce the revised ANS X3.9 Fortran

To inform the public of all its actions

To respond to the needs of the Fortran community throughout the world

The public has responded enthusiastically and overwhelmingly in favor of the committee's actions, and eagerly awaits the new standard. The international standards body is prepared to proceed immediately with the new American National Standard X3. 9-1977 Fortran as the basis for revision of ISO R-1539 Fortran. In response to public demand, X3J3 has initiated work leading to the preparation of the draft proposed revision document to meet the next mandatory revision cycle.