

A Politico-Social History of Algol†

(With a Chronology in the Form of a Log Book)

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Introduction

This is an admittedly fragmentary chronicle of events in the development of the algorithmic language ALGOL. Nevertheless, it seems pertinent, while we await the advent of a technical and conceptual history, to outline the matrix of forces which shaped that history in a political and social sense. Perhaps the author's role is only that of recorder of visible events, rather than the complex interplay of ideas which have made ALGOL the force it is in the computational world. It is true, as Professor Ershov stated in his review of a draft of the present work, that "the reading of this history, rich in curious details, nevertheless does not enable the beginner to understand why ALGOL, with a history that would seem more disappointing than triumphant, changed the face of current programming". I can only state that the time scale and my own lesser competence do not allow the tracing of conceptual development in requisite detail. Books are sure to follow in this area, particularly one by Knuth.

A further defect in the present work is the relatively lesser availability of European input to the log, although I could claim better access than many in the U.S.A. This is regrettable in view of the relatively stronger support given to ALGOL in Europe. Perhaps this calmer acceptance had the effect of reducing the number of significant entries for a log such as this.

Following a brief view of the pattern of events come the entries of the chronology, or log, numbered for reference in the text. These log entries are taken primarily from published articles, news and minutes. However, they are necessarily much abridged, as people seldom write compactly for history. The responsibility for their choice and abridgement is mine, and considerable care has been taken not to quote out of context and either misrepresent or misportray any of the actors (mostly

† The introductory text is adapted from the introduction to C. P. Lecht, *The Programmer's ALGOL*, McGraw-Hill, 1967.

living) in the ALGOL drama. Also included is a reasonably comprehensive bibliography of papers, books and meetings which show primary emphasis on ALGOL.

The Pattern

ALGOL was started with high hopes for both universalism and efficacy. The first occurred slowly because of business practicality, the slowness of communication in such a large field, and the lack of a controlling body. The second lagged because such a language matures slowly, being dependent upon actual usage and experience for feedback and improvement. Some of the U.S. participants in defining ALGOL 60 had just returned from the Paris meeting when a so-called "rump" group demonstrated the ambiguities they had unwittingly approved.

One can give several reasons for this slow maturation. They are:

1. INEFFECTIVE DESCRIPTION AND PUBLIC RELATIONS

The advantages and power of ALGOL (perhaps as compared to FORTRAN) were not obvious to all because the desirable nature of its improved logical rigor and generality were not publicized effectively [75]. The first, and perhaps the fortieth, description of the language was couched in such terms as to repel the practicing programmer of that day, particularly in the U.S. That this trepidation was due to the form of presentation was illustrated strikingly by Rabinowitz's paper, "Report on the Algorithmic Language FORTRAN II," in the 62 June issue of the *Communications of the ACM*. The title is identical to that of the Paris report except for the name of the language, and the description is given correspondingly in Backus Normal Form. As such, it looks far more forbidding than ALGOL; at the very least it demonstrates many more exceptions and structural faults.

Supporters of the language were in agreement that action was needed [77], and some arguments were made that usage was not really that difficult [107]. More than this, correct ALGOL usage seemed easier to achieve [115]. Other attempts were made to popularize the representation [75], but the flexibility and power obviously frightened the average practitioner.

2. DIFFERENCE IN ORIENTATION BETWEEN THE U.S. AND EUROPE

In 1958 the volume of work done with a formula language in Europe was only a fraction of that in the U.S., roughly paralleling the disparity in numbers of computers in use. Thus a reasonably fresh start was

possible [2]. The U.S. community felt itself to be more practical and suspected the Europeans of idealism. Indeed, it was not possible to assume that professional adoption of ALGOL in Europe implied full international acceptance [87]. By number of countries, yes; by number of users, no. An ISO standard for the language is possible only at the end of 1967, because requirements for such a standard transcend what was envisioned in 1958, or even 1961.

ALGOL should have progressed more rapidly in the U.S., for the powerful SHARE organization certainly gave it initial support [14]. SHARE had planned to stop further modification to FORTRAN and adopt ALGOL [19, 26]. Yet later it withdrew acceptance [93] and proceeded with FORTRAN IV, even though that language was also incompatible with its predecessor [74]. Primarily this was due to a vested interest in FORTRAN programs [112, 128, 138], despite published reasons of failure to achieve a successful processor [92, 93]. Europeans who puzzled over this, in light of their own successes [36, 50], will now find this easier to understand with the recent failure of the Decimal ASCII card code (adopted for a while as an ECMA standard) to hold under the onslaught of the vested interest in Hollerith-based codes.

Whereas the U.S. Government gave strong support to the COBOL language, for business data processing, they did not to ALGOL. In contrast, the German Research Council desired that all computers at German universities be equipped with ALGOL processors as a condition of placing an order. Since it reportedly provides 95% of the funding for this purpose, the support is assumed to be strong [179].

3. ACCENT ON PRODUCTION

ALGOL came on the scene just when U.S. users were engaged in a struggle to achieve production to justify all that expensive computer equipment they had ordered for purposes of advertising and keeping up with the Joneses. Thus most ALGOL processors were experimental at a time when FORTRAN was well into production. This pushed FORTRAN from version I to II, where programs already converted into machine language could be called for execution by a FORTRAN program. In many cases these pre-compiled subprograms may have been written in another procedure language, such as COBOL. Some installations made a practice of using FORTRAN as a linkage skeleton, with the main part of the working program written in other languages. Such usage was not applied in volume to ALGOL, and some claimed [136] that it could not be done [141, 171]. Spuriously, of course (see ALGOL for the UNIVAC 1107, calling FORTRAN and machine language subprograms).

4. INEFFECTIVE MAINTENANCE

ALGOL was the first language attempted originally on an international scale. FORTRAN was for some time under the control of a single manufacturer and COBOL was under firm industry supervision. ALGOL, however, was opened to all who had an interest [55]. This led to heterogenous membership in maintenance groups [84], many of whose members had no conception of what the term "maintenance" meant to the others [60]. This led to the abortive Oak Ridge proposal [64, 73]. Universities and research centers did not have the same requirements as a manufacturer, who could be forced to pay heavy contractual penalties if software did not perform properly. In this case it became "properly according to whom?" [100].

This was the problem facing IBM, whose recognized leadership in the computer field might have put ALGOL over sooner, had they been so inclined. IBM ALGOL was available [103], consisting of ALGOL where ALGOL and FORTRAN did the same function, and FORTRAN where ALGOL was lacking, such as in input-output statements at that time. But formal control was lacking, and IBM seemed to avoid wisely the political situation. While they could have, they did not wish to usurp control. Better to be prudent and not risk the vagaries of someone "actively engaged in writing programs in the ALGOL 60 language" [55] who has a committee vote equivalent to that of IBM!

This was finally expressed with sufficient strength [90, 91, 108] and control was vested [118] in IFIPS (now IFIP), a responsible body which has mounted an excellent effort leading to resurgence in ALGOL.

5. RESTRICTIONS ON CHARACTER SET AVAILABLE

The expanded character set of ALGOL (116 symbols requiring some graphic representation, such as ? for *if*) appeared far in advance of hardware which could handle it properly. The obvious device of a publication and reference language did not suffice in actuality. The ALCOR group felt this problem strongly [36, 186]. Predictions were ignored [5] (*CACM* 2, No. 9, p. 19) and then the users found out the difficulties. Meanwhile the development of the ISO (ASCII) code was taking place. Double case alphabets are still rare, although Teletype had an experimental terminal in 1965 and showed a special Model 37 terminal in Spring of 1967. A proposal was made [125] to reserve a set of switching characters, following the ESCape character, for programming language usage, but this was never understood or followed up.

6. LACK OF INPUT-OUTPUT PROVISIONS

This has been a very real deterrent to the acceptance of ALGOL for production computation [103, 132, 133, 144, 148, 161, 163]. Fortunately some excellent work appeared at a critical time [156], which has alleviated the problem significantly [187].

The Benefits of ALGOL

1. INTEREST

ALGOL provided the first big vehicle for international discussions on a commonly developed language for the computing field, and put a lot of people to thinking, which is continuing. It was acclaimed, damned, and then treated respectfully with the growth of fuller understanding. Until the end of 1960, *Datamation* (presumably the leading U.S. periodical in the field) took very little public notice. Around the end of 1961 the interest started to run high and was maintained through 1964, gradually decreasing from that time.

2. NOTATION

Inadequacies in the ALGOL 58 Report led John Backus to propose the essentials of a new method in 1959 [24]. Woodger states that prior to this no European ALGOL specification of comparable formality either existed or was considered necessary. Dubbed BNF, or Backus Normal Form, it was one of several independent developments. Knuth suggested (*CACM* 7, No. 12) that the initials stand for Backus Naur Form, but then Ingerman discovered (*CACM* 10, No. 3) virtually the same scheme prior to 200 B.C.! Regardless of this, it was the metal-linguistic tool which provided impetus to further developments in languages, construction languages and processors. Many consider it the most important characteristic of ALGOL 60.

Knuth also points out how the Report has given implicitly standard terms and definitions for programming terminology, e.g., statement, declaration, type, label, primary, block, etc.

3. UNDERSTANDABLE ALGORITHMS FOR HUMAN MACHINE INTERCHANGE

The interest of most numerical analysts has been captured by the possibility of describing their processes in a way that is at the same time very readable for understanding and also suitable for machine translation on a variety of equipment to produce working programs

which perform those processes. A relatively large number of algorithms have been published in:

Communications of the ACM (U.S.A.)
The Computer Journal/Bulletin (U.K.)
B.I.T. (Scandinavia)
Algorytmy (Poland)
Numerische Mathematik (Germany)

Also in *Selected Numerical Methods* (Gram, Regnecentralen, Copenhagen, 1962, 308 pp.)
Computer Programs for Physical Chemistry
 (Maine and Seawright)

Ageev has edited a Russian translation of the *CACM Algorithms*, Nos. 1–50 in 66 May, Nos. 51–100 in 66 June. Indexes of algorithms have been published in the *Communications of the ACM*, in the issues for 62 Jan, 64 Mar, 64 Dec and 65 Dec. Apparently missing is the *Taschenbuch* [35, 59], which was to be a handbook in five or more volumes published by Springer-Verlag. Designed to be a compendium of numerical knowledge encapsulated in the ALGOL language, this is not yet available, although typescript for a part of Vol. 1 was reported to be in draft form in 66 Oct. Possibly a sufficient body of algorithms has not yet been accumulated in a comprehensive manner.

4. AS A CONSTRUCTION LANGUAGE AND FOR SUPERSTRUCTURES

I stated in 1962, at the Armour Research Foundation, that “languages of the future, whether or not they be outgrowths, modifications or adaptations of our present languages, will survive only on the basis of being both introspective and reproductive. They must have the facility to talk about themselves and specify their processor in their own language.” ALGOL has been more successful than most in this area. van der Poel offered at the Rome meeting to supply a version of ALGOL written essentially in ALGOL. Burroughs did ALGOL for the B5000 in this manner, and so did Bull General Electric for the 600. More than this, it has been used as a construction language for other processors.

Both FORTRAN and ALGOL have been used as bases for superstructures of other programs, both applications and other languages. An exceptional example of this is SIMULA, done by the Norwegian Computing Centre, which is both connective to and written in ALGOL. It is my opinion that ALGOL has so far lent itself more suitably for this purpose than any competitor of standing.

5. EFFECT UPON COMPUTER DESIGN

It has been tempting to ascribe to ALGOL influence the pushdown stores of the English Electric KDF9 and the Burroughs B5000, which were introduced during the early ALGOL period, especially since the design and advertising goals of the latter machine were oriented to direct usage of ALGOL (and COBOL). This was because of translation methods variously labelled stacks, cellar, LIFO (last in, first out), and the like, which were utilized in ALGOL processors. Although these techniques are related, the basic hardware ideas were of a much earlier vintage. It is said that they appear in the B5000 because it was easier to translate to Polish notation than to one-address machine language. Direct ALGOL effects upon the B5000 are illustrated by the “operand call”, specifically tailored to the “call by name” of ALGOL. Like languages also had a considerable effect upon design of computers for operating directly from source language without translation, such as the ADAM computer by Rice and Mullery of IBM.

6. A LANGUAGE FOR NEW GENERATIONS OF COMPUTERS

ALGOL X and Y are being developed as successors [166, 169, 173] to ALGOL 60. There was formerly an inexpressible and intuitive feeling by ALGOL proponents that the elegant and simple structure was of great value [122], but this could not be shown to enough advantage to convince FORTRAN users. Multiprocessing, multiprogramming, reactive operation, time-sharing and realtime environments provided the crucial evaluation. The basic power of ALGOL is more evident now that facilities must be provided in a language to handle these new complications. This was evident in IBM’s switch [161, 169, 172] to a new language with many of the features of ALGOL. However, IFIP has not been relaxing in its role of custodian for ALGOL. ALGOL X shows many differences from ALGOL 60. For example, Naur has proposed [171] an environment and data division. The lesson of 1959 COMTRAN has been learned.

7. DISPELLING A MYTH

At the beginning of the ALGOL effort, SHARE was promoting UNCOL, or *UNiversal Computer Oriented Language* [4], but its proponents do not seem much in evidence these days. The first APIC *Annual Review in Automatic Programming* had an article indicating that no UNCOL processors were running yet, due to the fact that language specifications were incomplete. One wonders where it is after these eight years; apparently the last published paper was that in the 62 Jan

Computer Bulletin. We should hesitate to compare it to the philosopher's stone, however, because successful processors have been constructed with special purpose languages just one step up from the UNCOL concept.

Summation

A few quantitative measurements are perhaps useful to round out this special history:

1. Interest in ALGOL has been international since its inception. However, the circle of interested countries has expanded recently. The mailing list for *ALGOL Bulletin* No. 19 included recipients in:

Australia	Czechoslovakia	Italy	Sweden
Austria	Denmark	Japan	Switzerland
Belgium	France	Netherlands	United Kingdom
Canada	Germany W.	Norway	United States
China	Germany E.	Poland	U.S.S.R.

By the time of *ALGOL Bulletin* No. 25, this group was augmented by:

Argentina	Hungary	Israel	South Africa
Brazil	India	Mexico	Spain
Finland	Irish Republic	Rumania	

This same *ALGOL Bulletin* is the best way to note the progress of ALGOL X and Y. Copies may be obtained from three sources:

- (a) The Mathematical Centre, 2e Boerhaavestraat 49, Amsterdam-0, the Netherlands (attention M. F. Calisch).
- (b) P. Z. Ingerman, RCA, EDP Bldg. 204-2, Camden, New Jersey 08101, U.S.A.
- (c) SIGPLAN Notices, C. J. Shaw, Editor, System Development Corporation, 2500 Colorado Avenue, Santa Monica, California 90406, U.S.A. (The *ALGOL Bulletin* is reprinted in these notices upon issuance.)

2. ALGOL is sometimes considered to have fathered a number of variants [64] such as Mad [75], JOVIAL [99, 129], CPL [167], NELIAC [129], BALGOL [115], ALPHA [182], etc., whereas FORTRAN is often considered to be pure. About the only difference I can see is that the authors of the ALGOL variants gave them different names, while the authors of the FORTRAN variants for the most part retained the name, regardless of difference in available features and operational effect of common features. One survey of the different FORTRANs (prior to standardization by ASA, now USASI) showed over a dozen, of which eight existed within IBM itself. Then too, FORTRAN II is

quite different from FORTRAN I, and FORTRAN IV goes so far as to be intentionally incompatible with FORTRAN II [74]. This is reflected in the USASI Vocabulary, which defines FORTRAN as "... Any of several specific procedure oriented languages."

3. In comparing ALGOL to FORTRAN we note the following:

(a) From a publication and paper viewpoint, the KWIC index to the AFIPS Conferences, 1951–1964, shows two papers on ALGOL and one on FORTRAN (the original), and is inconclusive. The KWIC index to Computing Reviews (ACM), 1960–1963, shows 49 papers on ALGOL to 11 on FORTRAN, but this is certainly equalized by the fact that FORTRAN is by far the earlier language. It arrived at a time when most of the present journals in information processing, such as the *Communications of the ACM*, were non-existent, and naturally the most papers would arise during the earliest life of a programming language.

(b) From the standpoint of the number of published algorithms, ALGOL holds a commanding lead.

(c) The number of books and texts could be considered roughly equal.

(d) When last surveyed, the number of processors for various computers was about equal (*CACM*, 63 Mar). Despite a formal request through the *ALGOL Bulletin*, the ISO survey [125] has not been updated in this area. W. McClelland, director of the ISO/TC97/SC5 survey at the time of its publication, reports that lack of information forced the disbandment of that subgroup. However, the number of ALGOL processors has certainly increased considerably since that time, possibly more in proportion than FORTRAN. The 64 July *ALGOL Bulletin* reports eight compilers in use in Japan, with four more under construction, where the original survey showed none.

(e) The comparative numbers of users can only be estimated, based upon such information as [185], which showed FORTRAN programs at about ten times the number of ALGOL programs (for the U.S. only), but one could guess that perhaps only four times as many FORTRAN programmers exist, which seems quite remarkable in view of the previous quantitative comparisons. Even this comparison can be faulty, for it does not consider the increasing proportion of programmers who know and utilize both languages.

Concluding, I commend ALGOL and its future to the independent thinkers like Professor Galler [178]. If something proves practical and of substance, use it, but not for the sake of nationalism, entrenchment or prejudice. ALGOL, in its many manifestations and effects, has won a secure place in information processing history.

The Algol Log

- [1] 57 Resolution signed by twelve representatives of various
 May user groups such as SHARE, USE and DUO, at a meeting
 10 in Los Angeles:
- “We, as users of diverse machines, recognizing that developments in the use of automatic computers are leading to techniques of programming which transcend the characteristics of particular machines, that communication between users of different machines is highly desirable, and further, that completed programs which are machine independent appear to be possible, recommend that the ACM take the following action:
- a. Appoint a committee to study and recommend action toward a universal programming language.
 - b. Set up means for the rapid exchange of practical information on computer programs and programming among all computer users.
 - c. Appoint a committee to study and recommend areas of standardization. . . .”
- (Reported in DATA-LINK, 57 Oct)
- [2] 57 Letter from GAMM members to Prof. John Carr, III,
 Oct President of ACM:
 19
- “We, that is, Messrs. Bauer, Bottenbruch, Lauchli, Penzlin, Rutishauser and Samelson—have gathered here at Lugano for one of our regularly scheduled working sessions under the auspices of our formula-translation project. As Bauer and Bottenbruch have already told you in Ann Arbor, we are working on the logical structure of a formula translator that will form the basis for the formula translation program of the computational groups in Darmstadt, Munich and Zurich, and in the future at several other European installations. The program committee of the *Gesellschaft für angewandte Mathematik* (GAMM—Society for Applied Mathematics) under the chairmanship of Prof. Heinhold is functioning as the coordinating agency. Considering its circumference and the direction in which the project has moved, it appeared to us from the beginning that only a joint effort was possible despite the underlying difference of the machine types involved.
- Our work is largely finished. In particular we have, after overall discussions, agreed on one language that in our opinion fulfils the following basic conditions:
- (1) It depends directly on ordinary mathematical formula language.
 - (2) It is “self-explanatory”.
 - (3) It brings directly into the expression the dynamical nature of the calculational event.
 - (4) It is independent of the technical characteristics of the computer.

In order to stay in the area of what we believe we can cover, we have confined ourselves to the description of “scientific computations”. We have endeavored from the beginning to avoid the possibility of deviations from existing earlier proposals (Rutishauser 1951, FORTRAN, partly also PACT).

Guided by the news and reports that Bauer and Bottenbruch have brought back from America, we have decided that our hitherto existing proposals also largely agree structurally with Perlis’ IT language and the Remington-Rand Math-Matic. This agreement is most striking with Math-Matic, the most recent of the listed proposals.

We consider it a misfortune that at this time several different languages exist, but none of these languages appears to overshadow the other enough so that this would offer a reason for selecting it. We would like to avoid increasing this bad situation by setting up in Middle Europe one more such language.

Bauer and Bottenbruch have talked with several mathematicians, in particular also with you, about these questions. From this the idea here has gradually crystallized from a joint conference to make the attempt to work out a basis for a uniform formula language. However, this must be set about at once, since in the present state of development in a few months it will already be definitely too late when the different languages will not only be installed in the different user circles but in use.

We would therefore make the following proposal to you as the President of the ACM: The President of the ACM and the President of the Programming Committee of the GAMM issue a joint call for a closed conference of those people active in the area of formula translation. The task of this conference shall be:

- (1) To clarify how much the logical structure of those formula languages which are already in existence permit an adjustment,
- (2) To fix upon a common formula language in the form of a recommendation.

... Bottenbruch and Bauer have informally already talked with persons at IBM and Remington-Rand who have stated their interest. We think, however, that also the Universities should be represented in order to be able to contribute the experience of users. We hope to expand the circle through representatives from England, Holland and Sweden. ...

For dates we would propose January–February 1958, length 2–4 days. ...

We are presently preparing a comparative summary of the existing completely constructed formula languages, which could be placed at the disposal of the participants as the basis of the discussion. ...”

- [3] 57 John Carr, President of ACM, to the ACM Council:
Oct “I am enclosing a letter recently received from Drs. Bauer and
26 Samelson of the University of Munich, Dr. Bottenbruch of Technische Hochschule, Darmstadt, and Prof. Rutishauser and Drs.

Lauchli and Penzlin of Zurich, Eidgenossische Technische Hochschule.

The letter is generally self-explanatory. In light of the resolution of the National Council of the ACM in June at Houston, I am tentatively accepting the invitation of the European group to hold a meeting on a universal computer language during the period from about January 20 to February 7, 1958,

Composition of Delegation. I am also proposing that there be an American delegation of six persons to this conference, three from industrial organizations and three from Universities . . . one individual each from Professor Morse's laboratory at M.I.T. and from Professor Perlis' laboratory at Carnegie Tech, and myself, representing the University of Michigan and the A.C.M. . . ."

- [4] 57 Francis V. Wagner, Chairman of SHARE, to SHARE
Nov Executive Board:
22 “. . . I believe very, very firmly that the establishment of a universal algebraic language for programmers to code in is a relatively trivial project. I do not feel that the existence of several such ‘higher order’ languages would particularly hurt the computing profession. (In fact, I think it necessary that there be many, each adapted to its own field.) On the other hand, I am absolutely convinced that the most important thing that is needed is a universal, intermediate, ‘computer’ language as described by Charlie Swift. . . .
I propose that we urge this august, academic body convened in Switzerland to not waste their time with universal algebraic ‘programming’ languages, but to devote their efforts exclusively to the important matter of an intermediate universal ‘computer’ language for a universal pseudo-computer. . . .”
- [5] 57 H. S. Bright to Professor John W. Carr, III:
Nov
26 “. . . Although this might be difficult on a world-wide scale, I believe that early profit could be achieved by some standardization on language elements at the first level above the bit, viz., at that of alphabet or, more generally, of characters commonly written as the least unit of language. . . .”
- [6] 57 Francis V. Wagner, Chairman of SHARE, to Dr. John
Dec W. Carr, III:
9 “. . . We are pleased that, as President of A.C.M., you are coordinating the affair and establishing the ground rules for the selection on the United States Delegation. We think, however, you are making a mistake in loading it so heavily with compiler designers and university people. . . .”
- [7] 57 John W. Carr, III, to ACM Council:
Dec
13 “. . . I have also talked briefly with Professor Perlis of Carnegie Tech, who indicated plans for a possible meeting among interested Americans at the Eastern J.C.C. meeting in Washington in December. . . .”

My personal feeling is that a great deal can come out of such a conference—not necessarily a common language, which I doubt can be achieved at one fell swoop, but rather an overall plan for arranging to translate languages one into another, standards for such languages, and at least a meeting of the minds on the goals and ways of reaching them. On this basis I feel that this, along with the contacts with the European group, could be of great benefit. . . .”

[8] 57 Francis V. Wagner to Dr. John W. Carr, III:
Dec “... It seems to me a shame to waste all this time and effort on just
20 another algebraic higher order language even though it purports to be ‘universal’. It seems to me that such an assumption is almost a contradiction in terms . . . the most useful manner of exploiting the computers of the future will be to encourage every discipline to develop a higher order programmer language which most ideally suits its subject matter. Thus there should be programmer languages for aerodynamicists, petroleum engineers, nuclear physicists, medical diagnosticians, clothing manufacturers, etc. Even if this were not technically sound. . . I maintain that human nature will make it inevitable. Thus an algebraic programmer language can never be universal, for lack of universal acceptance. . . .”

[9] 58 ACM Ad Hoc Committee on a Common Algebraic Lan-
Jan guage, first meeting.
24

[10] 58 XTRAN Announcement to SHARE, being an experimen-
Feb tal language intended to have the capability to express its
26 own processor.

[11] 58 ACM Ad Hoc Committee on a Common Algebraic Lan-
Apr guage, third meeting.
18 Professor Bauer was present and described the GAMM proposal. The ACM “Proposal for a Programming language”, 19 pp. in ditto, was prepared.

[12] 58 ALGOL Meeting in Zurich, attended by:
May GAMM—Bauer, F. L. ACM—Backus, J. W.
27 Bottenbruch, H. Katz, C.
Jun Rutishauser, H. Perlis, A. J.
2 Samelson, K. Wegstein, J. H.

The result was a report prepared by Perlis and Samelson, published naming the language both IAL (International Algebraic Language) and ALGOL (in later publications). Often called ALGOL 58 as a means of distinguishing it from ALGOL 60, although purists frown upon this.

- [13] 58 John Backus, SHARE Representative to Zurich Meeting,
 Aug to SHARE:
 14 “. . . It seems to me that this report represents a considerable step forward for that part of the scientific community interested in numerical computation. . . . It already appears that the language proposed will be used widely throughout the Continent (work on translators for a number of European machines has been started) and very likely in this country. . . .
- In conclusion, as your SHARE representative on the ACM Ad Hoc Committee on Languages, I want to urge SHARE to consider giving official recognition to the language proposed here. I do so because I am convinced that it is fundamentally sound, that no better language is likely to be approved in the near future by an international group representing the outstanding computing societies of the United States and the Continent, that the goals of SHARE would be greatly advanced by recognizing and using it, and finally that SHARE, by its adoption, would be making a major contribution toward transforming the field of numerical computation from a somewhat parochial and divided enterprise into a truly international scientific discipline.”
- [14] 58 Resolution adopted by SHARE XI:
 Sep “SHARE by this resolution commends and endorses the work of the
 11 ACM–GAMM International Conference on Algebraic Language, and in particular of SHARE’s representative, J. Backus, and his American colleagues, C. Katz, A. Perlis and J. Wegstein.
- Furthermore, SHARE intends to use this language as soon as it can be implemented. To this end, SHARE will take positive action to study the proposed International Algebraic Language and to implement its adoption as a SHARE standard.
- The immediate work should be carried forward by an Ad Hoc Committee on Algebraic Languages, which the President of SHARE is directed to appoint on September 12.”
- (Frank Engel was appointed chairman.)
- [15] 58 Report by A. E. Glennie at SHARE XI:
 Sep “Although British representatives did not attend the ACM–GAMM
 12 meeting on IAL, this does not mean lack of interest in the subject. In fact there have been at least six automatic coding systems used in England, the first in late 1951.
- The growth of automatic coding has come recently only with the advent in England of machines with large core storage systems. Earlier machines had storage mainly on drums, which makes automatic storage allocation extremely difficult.
- The British Computer Society is now awaiting the IAL proposals with a view to recommend them as standards for future British work in this area.”

- [16] 58 J. H. Wegstein letter to the ACM Council:
Oct “... Now that SHARE is supporting it, the IAL now appears to
20 have an excellent chance for success. . . .”
- [17] 58 Informal Meeting of the European ALGOL group at the
Nov University at Mainz.
- [18] 58 Minutes of the ACM Council:
Dec “The following resolution was adopted:
3 “The Council commends Professor Perlis on the activities of his
Committee and urges him to do everything possible at the Inter-
national Conference in Information Processing in order to secure
the international adoption of a universal computer language. The
Committee is further urged to work closely with the various User
Groups to secure domestic adoption also.’ ”

- [19] 59 IAL Committee Resolutions at SHARE XII:
Feb “*Resolution No. 1*
18–20 Whereas SHARE recognizes the importance of maintaining, at any
moment, a precise definition of the IAL (International Algebraic
Language) which constitutes in every detail an official ACM and/
or International Standard; and whereas SHARE also recognizes that
corrections, additions and improvements in IAL will occasionally
be desirable, be it hereby resolved that:
SHARE directs the executive board to take whatever steps it deems
appropriate strongly to encourage the ACM to establish formal
machinery for considering and giving official status to alterations in
IAL as a computing standard.

Resolution No. 2

The SHARE IAL Committee after extended discussion has agreed that an extended character set will eventually be required, and that for the effective implementation of the IAL language an extended set of at least 100 characters is needed now. We propose the following resolution for consideration by the SHARE body:

Whereas we deplore the inadequacy of the presently available limited character set and feel that more than 128 characters would be desirable,

be it resolved that SHARE recognizes a growing need for a more extensive character set, and recommends that IBM consider providing across-the-board input/output equipment to meet this need.

Resolution No. 3

Whereas SHARE considers that the IAL language should become a working language for communication with the 704, 709 and other SHARE machines, therefore be it resolved that:

In order to implement the creation of a working language, SHARE recommends that IBM begin development of an IAL translator; and

that the FORTRAN and IAL Committees be directed jointly to set a date for terminating modifications and extensions to the FORTRAN language.”

- [20] 59 European ALGOL Implementation Conference at Copenhagen.
Feb 28 Two major results were the procedure for publication of the *ALGOL Bulletin* and the formation of the ALCOR Group, primarily European users and particularly dedicated to hardware representation in existing equipment and processor identity.
- [21] 59 Publication of the first *ALGOL Bulletin*, edited by Peter Mar Naur of the Regnecentralen, Copenhagen, primarily for 16 the European group.
The language now appears to be called ALGOL; the first U.S. mention of “ALGOL” is apparently 59 Aug 14. A majority vote provision was described for policy in developing processors.
- [22] 59 Working Conference on Automatic Programming, Brighton, England.
Apr 1-3 Sponsored by the Automatic Programming Information Centre, Brighton College (Organizer—Richard Goodman).
- [23] 59 SHARE IAL Committee, Second meeting, New York.
May 1 The IAL Translator in process for the IBM 709 was described, together with proposals for expansion of available character sets via both hardware and software.
- [24] 59 International Conference in Information Processing, Paris.
Jun 15-20 Under UNESCO sponsorship. As a result of both official and semi-official meetings of interested parties, the *ALGOL Bulletin* was accepted as the general medium for discussion of all proposals for improvement and other questions for workers in the Eastern hemisphere, via Regnecentralen, Copenhagen, where it is published. For the Western hemisphere the *Communications of the ACM* was to serve the corresponding purpose. *ALGOL Bulletin* No. 4 reported: “During the conference in Paris important progress both towards the establishment of ALGOL as an accepted international algorithmic language and towards the completion of the first, definite version of ALGOL was made. Indeed, an Ad Hoc Subcommittee was formed for the discussion of (a) input-output, and (b) extensions of the language. The members of the Subcommittee were:
E. W. Dijkstra (Holland) A. J. Perlis (U.S.A.)
W. Heise (Denmark)—(Chairman) K. Samelson (Germany) . . .”
Of great importance to the ALGOL work was the paper presented to this conference by John Backus, “The Syntax and Semantics of the Proposed International Algebraic Language of the Zurich ACM-GAMM Conference”.

- [25] 59 Letter from R. W. Hamming (President, ACM) to M. A.
Aug Danjon (President, Association Française de Calcul) and
5 M. V. Wilkes (President, British Computer Society), in-
viting participation in the international ALGOL work.

An enclosure, signed by Hamming and Sauer (President, GAMB) in Paris during the June ICIP. Without dateline, address or other heading, it states:

“... The existing ACM–GAMB committee considers itself now a steering committee, whose responsibilities are:

- (1) to complete the Zurich report with respect to inconsistencies and obvious extensions (e.g., the Heise committee report);
- (2) to determine the procedure by which the membership will be modified from the pool of representatives specified by the various national (and supranational) organizations.

The selection procedure for membership in an international ALGOL committee will always be determined by competence and no fixed apportionment of members by nationality or organization will be considered.”

AFCal did not accept the invitation, B.C.S. did (59 Dec).

- [26] 59 SHARE ALGOL Committee Meeting, Seattle:
Aug “The following motion was passed unanimously:
17–18 ‘Whereas an orderly curtailment of modifications in FORTRAN is in process, looking toward replacement by ALGOL, motion No. 3 of SHARE XI is redundant and will not be resubmitted by the ALGOL committee.’
Motion No. 3 had to do with fixing a date for ending FORTRAN modifications.”

- [27] 59 Minutes of SHARE XIII, Seattle, reporting on a compari-
Aug son between ALGOL and FORTRAN, by Bill Heising of
19 IBM:
“1. ALGOL provides a media for universally describing problem procedures since it is not tied to a particular machine.
2. It is expected that ALGOL will be translated for a large variety of machines. Thus problems will not have to be recoded for various machines as in the past.
3. ALGOL is a better and richer language than any existing to date. . . .”

- [28] 59 Extracts from the Minutes of SHARE XIII, Reports on
Aug the ICIP Conference in Paris:
19–21 Frank Verzuh—“later, Tom Steel will inform you about ALGOL—
a language I consider important, very important to you people. . . .
Again, rather hurriedly, in Denmark, I enjoyed seeing what was being done by the Danish Institute of Computing Machinery, the

DASK Computer, and their application of it. I was very amazed, wherever I went in Europe, people would talk to me in ALGOL language, write it and describe their work on converters, translators, etc., which are being used.”

Tom Steel—“The ALGOL performance at ICIP was quite interesting in several ways. There was a section in the plenary section devoted almost entirely to ALGOL. It was billed as an automatic programming discussion, and it tended to be about very little other than ALGOL. . . .

Through this whole series of discussions there was a sort of running tacit assumption that ALGOL was a good thing. It seems there were some folks there that didn’t believe this, and a gentleman named Strachey from the United Kingdom got up and challenged this assumption publicly, and he challenged all comers to a debate. This debate actually took place. It was a special rump session of the conference and one entire morning was devoted to this. There were probably eighty or so people that participated in this discussion and it got rather heated a couple of times; in particular, there was one case when one individual made a comment, and somebody down the room made a snide comment about the competence of certain people, and unfortunately, his mike was live. Well, the net result of these discussions was really two-fold; one, I believe a recognition on the part of some of the proponents of ALGOL, particularly the Europeans who were relatively unfamiliar with data processing problems, that ALGOL is not (in its present form at least) a completely general programming language, that it is not satisfactory for certain types of data processing work. I believe nearly everybody recognizes this, but the way the discussion was going, it appeared that this whole problem was being glossed over, and this debate was well worth it, if this situation was cleared up, and I believe it is fair to say it was.

As an outgrowth of it, a group of people, including Samuelson and Bauer, people from the United States, got together and decided on a way of proceeding to recommend extensions to ALGOL that will handle the data processing area. There will be a meeting of this group in conjunction with the ACM-ALGOL committee at the next ACM meeting, next month, and I suggest that any of you who feel strongly about this subject and are interested, get in touch with the proper people, Bob Bemer of IBM, Bob Bosak of the System Development Corporation, and make your ideas known and participate in this meeting.

Actually, the debate as such ended with no conclusions drawn, each side was just as sure it was right as before, as one might expect. But it did clear the air a bit and explain to many people the differences in point of view. In particular, the British seemed to feel that now is too early to adopt such a language and it doesn’t look like their mind is going to be changed by talk.

In one of the symposia, there was a certain amount of discussion regarding the implementation of ALGOL, particularly in Europe. There are about five different efforts going on, largely in Scandinavia

and in Germany, where the processors or translators from ALGOL to proper machines are being conducted.

However, these processors are really not very ambitious. A rather difficult problem of procedures is just being glossed over at the moment. The translators are designed to do little more than scan single statements and construct arithmetic sequences. A great deal of effort is being devoted to such things as minimizing the number of temporary storages required for arithmetic sequence and this type of thing.

When we first heard about this, it was a little surprising. It seemed like a pretty low-level start. However, most of this work is being done on small machines with the main memory being a drum memory, and this clearly complicates enormously the problem of writing a general translator.

The Europeans were quite interested in the activity that is going on in this country toward implementing ALGOL, and a number of ideas were exchanged that, I think, will ultimately prove quite fruitful.”

- [29] 59 Resolution adopted at SHARE XIII, Seattle, for general
Aug distribution:
21 “SHARE has already commended the ACM for its sponsorship of the American effort in the design of the prototype version of ALGOL. However, it deplors that current work on its development and implementation is receiving no leadership from ACM, so that user groups and independent organizations must provide their own, and coordinate only on a haphazard basis. . . .”
- [30] 59 ACM Programming Language Committee meeting in
Nov Washington:
5-6 “. . . The purpose of this meeting (at the National Bureau of Standards) is to discuss:
- (i) The resolution of ambiguities in (the first draft version of) ALGOL.
 - (ii) The drafting of a set of improvements and extensions to ALGOL is recommended by some of the ACM membership through proposals published in the *Communications* during 1959. . . .
 - (iii) The selection of a subcommittee to represent the ACM at the second international conference on ALGOL to be held somewhere in Europe early in January, 1960. . . .”
- A. J. Perlis, Chairman

Membership: Backus, Green, Katz, McCarthy, Perlis, Turanski and Wegstein (for Paris), Bemer, Evans, Gorn, Rich, Dobbs, Desilets, Goodman and Levine.

- [31] 59 European ALGOL Conference at Compagnie des Mach-
Nov ines Bull, Paris:
12-14 “Subject—Discussion of the proposed modifications of ALGOL, and
preparation of the International ALGOL Conference (to be held in
the U.S., possibly Philadelphia, around New-Year. . . .” (49 atten-
dees.)
- [32] 59 ACM Programming Language committee meeting in
Nov Boston, in preparation for ALGOL 60.
30
- [33] 59 A. W. Holt to A. J. Perlis and the ACM Programming
Dec Language Committee:
1
“At your invitation, I came to Washington D.C. on November 6,
1959, in order to present to that committee a descripton of “Can-
onical Form” for programming languages—one of the results of
the work of W. J. Turanski and myself. . . .
With reference to ALGOL (in its present state) there are several
features of that language which concern themselves with canonical
form functions (such as DO statements). In fact some of these
features lie at the base of current controversy within the Language
Committee precisely, I believe, because there has not yet been
recognized a clear-cut distinction between signals which serve copy-
edit functions vs. signals which ultimately refer to the flow of
control.”
- [34] 59 From the Minutes of the December 2 Meeting of the
Dec String and/or Symbol Manipulating Subcommittee of
2 ACM Programming Languages Committee:
. . . The main subject of the meeting was the string manipulation
facilities to be added to ALGOL. The only recorded agreement was
that the strings in question are strings of ALGOL characters. . . .
- [35] 59 Minutes of the ACM Editorial Board Meeting:
Dec “The Communications, under the editorship of Joe Wegstein, will
2 start a new department for algorithms in ALGOL language. This is
a venture analogous to that proposed by Springer-Verlag (for which
A. S. Householder is an editor). Our algorithms may be published
eventually in the Springer Handbook; in any event, we look for a
reciprocal relationship with that firm. . . .”
- [36] 59 ALCOR Hardware Group Meeting in Mainz, Germany,
Dec at the Institut für Angewandte Mathematik.
17-19

- [37] 59 Professor F. L. Bauer to the Conference members:
Dec “In accordance with existing agreements, you are cordially invited
19 to take part in the International ALGOL Conference 1960, to be held in Paris, beginning January 11, 1960, at 9:30 a.m. Participants will meet at IBM World Trade Europe. . . . The purpose of this meeting is to produce the ALGOL 1960 report based on the material screened by the American and European groups.”
- [38] 60 Meeting of the “Paris 13” to produce the ALGOL 60
Jan Report.
11–16 Originally 14 members existed, but William Turanski of the ACM delegation was killed in an accident just prior to the meeting. The report is dedicated to his memory.
- [39] 60 Ascher Opler, in *Datamation*:
Jan “The transition from acceptance of FORTRAN to acceptance of ALGOL must take place in the next couple of years. . . .”
- [40] 60 Julien Green of IBM lectures at Johannes Gutenberg
Jan University, Mainz, on: “Processing of the formula language ALGOL.”
19
- [41] 60 M. Woodger to P. Naur and K. Samelson:
Jan “I enclose a syntax of ALGOL 60 which is complete in as far as I
25 understand the agreements reached on Saturday, 16th January in Paris . . .”
It appears that at least partial credit for editorial work on the ALGOL 60 Report must be extended to Mr. Woodger as well.
- [42] 60 Peter Naur to the members of the ALGOL 60 Committee:
Feb “Enclosed I send you the first draft of our report. . . .”
4
- [43] 60 ALGOL Committee Report, SHARE XIV:
Feb “The SHARE ALGOL Committee . . . heard a discussion of the UM
17–19 MAD Compiler for the 704; the relation of its language to ALGOL, and some of the features of the processor itself.
Inasmuch as UM MAD is about to be offered for distribution through SDA the Committee, after due consideration, decided to take no action relative to accepting UM MAD as the SHARE 704 ALGOL Compiler because of the variance of MAD from ALGOL as adopted by SHARE. . . .
The SHARE ALGOL Committee has seen a draft of the ALGOL 60 and believes it to be a substantial improvement over the previous version. When it is published by the ACM the Committee recommends that the SHARE membership use the language for publication of procedures in order to further the development of the language.

IBM reported that final checkout of the second 709 ALGOL processor is under way. It is expected that this processor will be ready for distribution in May, 1960. This version of the processor produces SCAT instructions as output and it is intended as an interim processor to provide a further developmental experience with ALGOL."

- [44] 60 Remarks by A. L. Harmon to SHARE XIV:
 Feb “. . . Since the development of the ALGOL language has not reached
 17-19 the point where it seems advisable to expend the manpower required for a full processor that SHARE seems to deserve, based upon the recommendations of the SHARE ALGOL Committee, IBM will not produce an official ALGOL processor at this time. However, IBM will continue to support the ALGOL efforts in the areas of language development, translation techniques and, of course, processor development.

Questions and Answers

MR. FRANK ENGEL (WH): I believe as I entered the room I heard the statement to the effect that IBM is not intending to produce an ALGOL processor at this time. Is that correct?

MR. HARMON: A full ALGOL processor. That is correct.

MR. ENGEL: Oh; we're going to qualify it.

I understand that IBM is committed to the SHARE ALGOL Committee and to the SHARE body to produce an ALGOL processor operating in May of this year.

MR. JULIEN GREEN (IB): We did promise to have an experimental version ready by May. We can have this version ready. But this will not be a full-blown processor in the sense that, well, we didn't promise to have it to do sufficient coding. We are supposed to have the output in a form so that it will have to go into the SOS system before you can get your object programs, and this is as far as we have the processor at this point, and this is what we could have available, but this is merely for testing the language and for getting used to the language, rather than producing production programs, let's say.

MR. M. A. EFROYMSON (ER): I believe that some sentiment was given in past meetings that there would be an attempt at continuity of effort so that there would be a logical transition from FORTRAN to ALGOL, through some kind of processor between the two systems. I am not clear from your remarks whether this consideration of the evolution or revolution from FORTRAN to ALGOL is still the philosophy or not.

MR. HARMON: Yes, this is still our philosophy, and for further amplification of this I would like to again ask Julien Green to make some comments.

MR. GREEN: I think at one point we do want to use an ALGOL language. However, I don't think we are prepared at this time to cease all FORTRAN effort and say "Let's transfer immediately to

an ALGOL language,” because I don’t think the ALGOL language has been developed to the extent where it is worth doing this.

- [45] 60 Professor M. R. Shura-Bura (Chair of Computing Mathematics, Moscow State University) to Professor John W. Carr, III:
Mar 21

“The specialists working in the Soviet Union in the region of computational mathematics and programming are developing a large interest in the project for the algorithmic language ‘ALGOL’.

I would be extremely grateful to you for information about the development of the project and accounts of practical application of the ideas of the project. . . .”

- [46] 60 B. Vauquois to the Authors of the ALGOL 60 Report:
Apr 7

“The AFCAL Committee (Association Française de Calcul) has asked me to organize the diffusion in France of ALGOL 60. In order to do so, it seems that the best mean would be a translation of ALGOL BULLETIN SUPPLEMENT No. 2 into French with more examples. The next issue of the periodic paper “Chiffres” could present this translation.

Before printing, Mr. GENUYS, Mme POYEN and I could go to Mainz in order to check the validity of translation and examples with Prof. Bauer and Samelson. . . .”

- [47] 60 R. S. Barton to Millard H. Perstein, Secretary of SHARE, in SHARE Secretary Distribution No. 69:
Apr 7

“In view of your interest in programming systems and problem-oriented languages, I am enclosing for your perusal a description† of the Burroughs version of ALGOL 58. This description follows closely that published in the December 1958 *Communications of the ACM*.

A translator for this language for use with the Burroughs 220 is in field test at Stanford Research Institute this week. Translation rate averages 500 machine instructions per minute. The system is designed for “load and go” operation and has facilities for debugging programming at the POL level and provision for segmentation of programs. Certain general input-output and output editing procedures are provided. The character set used is one available on standard keypunches.

Many new techniques have been utilized in this compiler and particular design emphasis has been put on the elimination of special rules and restrictions, as well as translation speed and ease of use operationally. . . .”

† *The transliteration of ALGOL to the Burroughs Algebraic Compiler Language, A guide for the mathematically trained programmer.*

- [48] 60 J. H. Wegstein to Julien Green:
 May “After studying CLIP, OMEGA, and XTRAN, I think that we fell
 12 down at Paris in not declaring strings in Algol. The enclosed pro-
 posal† is one which I would like to discuss at the Symbol Manip-
 ulation Meeting, May 20–21.
 It seems to me that it would be very desirable to extend Algol so
 that some of this string work could be standardized. We find this
 proposed notation useful for some of our data processing problems,
 and it would be very nice if we could code now for our hoped-for
 STRETCH Computer (in 1961) in this language.”
 † By Wegstein, W. W. Youden and G. M. Galler.
- [49] 60 SHARE ALGOL Committee Meeting, in Pittsburgh.
 May Agreed were:
 23–25 “(a) a SHARE ALGOL 60 hardware representation,
 (b) input–output procedure specifications,
 (c) a general outline of the desirable ‘debugging’ features that the
 SHARE ALGOL 60 processor should have. . . .”
- [50] 60 First ALGOL 60 processor tested on the X1 computer in
 Jun Amsterdam.
 Constructed by Dijkstra and Zonneveld, it even handled recursive
 procedures. In fact, all the features of ALGOL 60 except dynamic
 own arrays were implemented. Operational in August 60.
- [51] 60 *Input Language for a System of Automatic Programming*
 Jul published in Moscow by Ershov, Kozhukhin and Volo-
 shin. Published in final copy in 1961 by the Siberian
 Section of the Academy of Sciences of the U.S.S.R.
 This work was machine-translated by the IBM Research Center,
 Tape No. 1785, 132 pp. This translation is of humorous interest
 because “input language” was translated by the program as “en-
 trance tongue”. The authors said they were surprised that the
 changes to ALGOL 58 to make ALGOL 60 corresponded to their
 point of view, and that this was striking because they had not given
 out any information (preliminary) on their working ALGOL 58
 processor. Actually this system and language goes quite a way
 beyond ALGOL 60, in particular, vector and matrix notation and
 operations are provided for.
- [52] 60 J. Wegstein to Members of the ALGOL Working Group:
 Jul “As various people undertake to write ALGOL 60 compilers . . .
 28 logical errors are found; and necessary changes are indicated.
 Obviously if ALGOL 60 is to be made to work as a common lan-
 guage, an effective mechanism for maintaining it must be established.
 Some of the Paris conferees are not following up the report with
 ALGOL implementation or even further interest. On the other
 hand, Peter Naur has recently proposed some changes (see enclosed

letter) and asks the Paris 13 to endorse them. I have asked Naur to delay publication until the U.S. ALGOL Working Group can consider them on August 22.

... Professor Perlis wishes to appoint the Working Group as an official working subcommittee of his standing Committee on Computer Languages. This subcommittee ... participate in the effort to secure international agreement on interpretations and changes to ALGOL 60. ...”

- [53] 60 M. I. Bernstein (Chairman, SHARE ALGOL Committee)
Aug to Millard Perstein, in SHARE Secretary Distribution
10 No. 74:

“If the SHARE membership (or the Executive Board) decides that they do want ALGOL 60 as a SHARE Standard Programming language, it will be up to the SHARE ALGOL Committee to produce a processor—IBM has so far refused to do the job.

The SHARE ALGOL Committee is in need of volunteers—very special volunteers—ones who are willing to work and contribute a non-trivial portion of their time to producing an ALGOL 60 processor. ...”

- [54] 60 Meeting of the ACM ALGOL Maintenance Subcom-
Aug mittee, in Milwaukee.
22

- [55] 60 From the Minutes of SHARE XV:

Sep “On July 27, 1960, Professor A. J. Perlis, Chairman of the ACM
11–16 Committee on Computer Languages, asked the ALGOL working
group to organize itself as an ALGOL maintenance group to be regarded as a subcommittee of his Committee on Computer Languages. He asked that a report be prepared for the parent committee when the next meeting is held. On August 22nd the ALGOL working group met in Milwaukee. Those attending came from manufacturers, universities, and computer using laboratories. ... The attendees representing 22 organizations agreed to form a subcommittee of the ACM Computer Languages Committee for the purpose of maintaining and interpreting the ALGOL 60 language. This group is expandable and it is hoped that a European counterpart of this group may be formed so that actions agreed upon by both groups may be regarded as official interpretations and changes to ALGOL 60.

There was a strong feeling among the group that there should not be many changes.

The criteria for new members, by organization, were voted to be the same as were set for the charter members, namely, that members (a) have written, are writing, or plan to write ALGOL-like compilers or are actively engaged in writing programs in the ALGOL 60 language, and of which there are quite a few people writing in

ALGOL 60, and (b) that they are willing to maintain ALGOL 60 as a reference language.

The group then proceeded to get itself a chairman and then took up the proposed changes by Peter Naur, the editor of the ALGOL 60 Report.

The group approved of three of his proposed revisions which are quite minor from the user's point of view but also quite subtle. They rejected one of his proposals and plan to make a substitute for this.

There were also some papers presented at this session: Forsythe on the 'Burroughs Algebraic Compiler and its use for ALGOL programs;' Ingerman on 'Dynamic Own Array Declarations;' Sattley on the 'Allocation of Storage for Arrays in ALGOL 60;' Irons, 'Comments on the Implementation of Recursive Procedures and Blocks;' Ingerman on 'A Way of Compiling Procedure Statements with Some Comments on Procedure Declarations.'"

- [56] 60 U.S. ALGOL 60 Maintenance Group Report:
 Sep "Notes on Organizational Rules: The ALGOL Maintenance Sub-
 12 committee is in an unusual position because it has a well defined language, ALGOL 60, with which to work. It is important not to do mischief by making major changes, but at the same time interpretations and some changes are necessary. A simple majority vote on a change seems too reckless and a unanimous vote might prevent any action from being taken.
- ... Eighty percent of the member organizations must repond to constitute a 'proper vote'. If at least 10 percent vote *no*, the proposal is rejected. If the proposal is not rejected and 70 percent vote *yes*, the proposal is accepted. . . ."
- [57] 60 SHARE ALGOL Committee Meeting, M. Bernstein,
 Sep Chairman.
 13-15 After a call for working volunteers the meeting was declared closed and all others asked to leave. It was agreed to produce an experimental translator based on work that IBM Applied Programming had already done. Mr. Bernstein reported to SHARE that:
- "In line with its original stated purpose, the SHARE ALGOL Committee met last May. Although several positive steps were achieved during the meeting, it appeared that implementation of ALGOL as a SHARE standard programming language was not feasible. As a result, the Chairman requested that members who are unable to contribute time and effort toward ALGOL implementation resign so that a committee of implementors could be formed. A call for volunteers produced enough manpower to attempt a short-range implementation of an experimental ALGOL translator for the 709/90 based on work already done by IB Applied Programming. It is the Chairman's hope that such a processor can be complete within the year and made available to those SHARE members who wish to experiment with ALGOL as a programming language."

- [58] 60 J. H. Wegstein to the Editor of the *ALGOL Bulletin*:
Sep “As the enclosed notes will explain, a U.S. ALGOL Maintenance
26 Group has been formed. We hope there will be an European counter-
part so that changes to ALGOL 60 that are approved by both groups
may be published as official interpretations and changes to ALGOL
60. . . . Please advise me of the European status of a mechanism for
maintaining ALGOL 60.”
- [59] 60 F. L. Bauer and K. Samelson to J. H. Wegstein:
Oct “. . . We are strongly against forming a similar European group in
20 parallel to an American one since this might either finally lead to
two different ALGOLs or be the first step to establishing committees
on a purely national basis with each country having its own repre-
sentation irrespective of active membership. . . . As a first step in the
direction proposed we hereby apply for membership in the ALGOL
maintenance group. . . . We are somewhat concerned over the
'change' part of the official aims . . . we would like to be sure that
all members of the group are fully aware of the fact that in Paris
all committee members were agreed that for some time to come the
report should not be touched except in the case that ambiguities
should arise which somehow must be removed. Therefore we feel
that all definite changes not necessitated by ambiguities although
they might and even should be discussed very thoroughly, should be
shelved for a period of two years at least as far as definite action (or
rather official approval) is concerned. . . .
- In this connection the project of the 'Taschenbuch' of algorithms to
be published by Springer deserves serious considerations. Preparations
have now reached a state where the editors are forced to freeze
the language to be used, which will be described in detail in an intro-
ductory volume. It is obvious that the ALGOL version thus described
will have to be used throughout the entire Taschenbuch, and at least
for the near future any changes in ALGOL would simply have to be
disregarded. If such changes were made, the people for whose
benefit both ALGOL and the Taschenbuch were intended in the
first place, namely the large class of engineers and scientists who have
to do extensive numerical calculations without knowing much about
computers and logics, will be the ones to be most seriously incon-
venienced by the confusion arising out of different versions of
ALGOL. Obviously all this holds for the algorithms reproduced in
your Comm ACM department as well. . . .”
- [60] 60 H. Rutishauser to the Editor of the *ALGOL Bulletin*:
Nov “After reading all proposals and counterproposals to remove the
15 imperfections of the ALGOL-report I am now convinced that in
order to avoid utter confusion, we have to *maintain* the ALGOL
word by word as it stands now. In order to avoid ambiguity we
simply should not use the elements which are not properly de-
fined. . . .”

- [61] 60 Working Conference on ALGOL, in Moscow:
 Nov “The conference was attended by representatives from the following
 16 organizations:
1. The Steklov Mathematical Institute of the Academy of Sciences of the USSR.
 2. The Mathematical Institute of the Siberian Branch of the Academy of Sciences of the USSR.
 3. The Computing Centre of the Academy of Sciences of the USSR.
 4. The Computing Centre of the Moscow State University.
 5. The Faculty of Mathematical Mechanics of the Moscow State University.
- The recommendations presented . . . represent the common point of view of all participants:
1. The participants of the conference feel that a continuation of the common work on the perfection and sharpening of ALGOL is necessary.
 2. As to the alternatives raised by Dr. Wegstein we prefer the creation of a European group rather than a fusion with the American group. . . .
 3. We are in favor of the voting procedure proposed by the American group.
 4. The organizations taking part in the working conference on ALGOL express their preliminary agreement to enter into the European ALGOL group. . . .”
- [62] 60 ACM Compiler Symposium, in Washington.
 Nov
 17–18
- [63] 60 Advertisement in *Datamation*:
 Nov/ “ALGOL* now at work for Burroughs Computer Users.”
 Dec
- [64] 61 Proposal to the ACM ALGOL Maintenance Subcommittee for a Policy on Changes to ALGOL 60:
 Jan
 1
- “1. For the present, changes to ALGOL 60 which would have the effect of invalidating programs acceptable under the syntax and semantics of the 1960 report shall not be approved unless they are necessary to eliminate logical inconsistency or ambiguity. Removal of ambiguities shall be accomplished in such a way that actual changes in the report are minimized.
 2. Changes to ALGOL 60 which will have the effect of invalidating existing programs shall, however, be considered to determine their utility, their implementability, and their effects upon the validity of existing programs. If found acceptable, they may be given tentative approval, to be confirmed when the time comes for an extensive revision of ALGOL.

3. Changes to ALGOL 60 which would *not* have the effect of invalidating programs acceptable under the syntax and semantics of the 1960 report may be approved whenever it can be determined that they meet the following criteria:
 - a. They are logically consistent with the present language.
 - b. They either extend the scope of algorithms which can be described by ALGOL, or increase the convenience of ALGOL as a programming language, or permit improvements in the object code which would be produced by a compiler.
 - c. No superior method of achieving the same end is apparent.

This statement of policy (proposed) is intended to serve as a compromise between two opposing arguments . . . the first . . . that a language in a constant state of flux cannot be expected to gain acceptance. . . . The second position is that a language which cannot describe common computing and data processing procedures is unlikely to gain full acceptance. . . . There will be strong pressure toward development of extended languages which can cope with various tasks of this type, and unless the ALGOL Maintenance Group is sympathetic towards the needs of such workers, there is likelihood of a second Babel. . . .”

[65] 61 Advertisement in *Datamation*:

Jan

“The Bendix G-20’s simplified programming enables your present personnel. . . . Such a programming system is ALCOM—An algebraic problem-solver based on the international mathematical language of ALGOL. Compatible with the ALGO† programming system for the Bendix G-15. . . .”

† Introduced in 60 Oct.

[66] 61 Open letter to Bob Bemmer, from Rene De La Briandais,
Mar in *Communications of the ACM*:

“As far back as Fall of 1958 I recall your mentioning that if ALGOL were not developed as rapidly as possible, FORTRAN would become an industry standard by default. . . . ALGOL has been with us in spirit for some time now, but that’s about all. . . . If it is the feeling of IBM that they do not wish to be accused of dominating the industry in the selection of a new ‘standard’ and therefore they will wait for the ACM or someone else to make this election, then in my opinion it is the wrong attitude for them to take. . . . Let’s have some action.”

[67] 61 Reply to the De La Briandais letter:

Mar

“. . . Although ALGOL is admittedly a superior language (it should be, for IBM’s own FORTRAN and experimental languages made heavy contributions), FORTRAN is the present workhorse and is operative in a large number of installations and understood by thousands of people. It would be unwise to give the user elegance

and take away productivity and efficiency. . . . Rene asks us to give him ALGOL now in place of FORTRAN. Does he wish to do without the input–output facilities and operating system of FORTRAN? . . . When there exists a language fairly safe from arbitrary change and when both the language and the processors offer enough further advantages to customers to offset the costs of re-education, programming modification, and general dislocation—then we will issue a new system with which the user may choose to supplant FORTRAN. . . . Despite the escape clause of the ‘reference language’, ALGOL will not really be usable until new input–output equipment exists which will handle the character set directly. This area is under experimental investigation, and the production of acceptable new hardware takes considerable time . . . standards are voluntary and have force only when embodied in specific law. . . .”

- [68] 61 Minutes of SHARE XVI—Report by A. L. Harmon:
 Mar “ . . . In connection with this, the ALGOL language has a significant
 22 influence on the direction of the FORTRAN growth. In particular, the present 7090 FORTRAN proposal includes several Algolic features. We feel that this is a proper interpretation of the desire of the SHARE body. In order to continue the joint investigation of ALGOL, this past January we delivered our contribution to the ALGOL Committee in the form of an experimental processor. . . .”
- [69] 61 Minutes of SHARE XVI—Introduction to the UNCOL
 Mar Committee Report:
 22–24 “The precise origin of the UNCOL concept is lost in the mists of time. Indeed, it has been reliably reported by Wagner that ‘it was well known to Babbage’. . . . Meanwhile, bigger things were on the horizon amidst the soundings of loud trumpets and great waving of arms—an International Algebraic Language.
- While the general pattern of events leading to the 1958 meeting in Geneva is well known, it is not so widely realized that these same events acted as a catalytic agent in the development of UNCOL. The early history of the effort toward design of this International Algebraic Language—or ALGOL, as it is now called—is worth examination in order to gain insight into the driving forces behind UNCOL. . . . Selected items of the relevant correspondence are reproduced in an Appendix to this report.
- Perusal of these letters shows that while ALGOL was in fact designed in response to the desires of the initiators of the effort, some individuals held objections, *ab initio*, on fundamental grounds to the direction taken by the ALGOL group. At three years distance these objections appear to have lost none of their basic soundness, the proliferation of dialects of ALGOL being the best evidence.
- The position of the recalcitrants was (and still is) simply that problem oriented language universality is neither possible nor desirable; that there should be individually tailored POLs for engineers, nuclear

physicists, cost accountants, global strategists or what have you; and that the *real* problem is the drastic reduction of the manpower and elapsed time required to provide a capability of using a given POL with a given machine. Nevertheless, the Pollyannas had their way and ALGOL was born.

It must be emphasized that those who disagree with the proceedings at Geneva *on the above grounds* have no quarrel with ALGOL *per se*. ALGOL is one of several algebraic, formula translation, problem oriented languages and should be judged on its own merit in this company. The objection is entirely against the highly advertised and quite invalid claim of universality in application.”

[70] 61 Minutes of SHARE XVI—General Session:

Mar “Mort Bernstein (RS) moved the adoption of the following resolu-
22–24 tion:

Be it resolved that the following letter represents the current opinion of the SHARE membership. The President of SHARE is directed to send it to the President of the ACM and to the editor of the *Communications of the ACM* for publication.

On request of President Cantrell, Bernstein read the letter referred to, which expressed SHARE’S dissatisfaction with ALGOL and rescinded SHARE’S endorsement and support of the language. (Secretary’s Note: The complete text of this letter will be found in Appendix F.7.) After the motion was seconded by Frank Engel (WH), President Cantrell called for discussion, which ensued as follows:

GEORGE TAIT (PP): I feel there are many present who have not given ALGOL a fair shake. I suggest that we do not vote on this letter until the August meeting, as its strong wording has some very serious ramifications.

F. J. CORBATÒ (MI): I think the letter has many controversial statements, and while I agree with many of its points, I would not like to see SHARE, as a body endorse it.

DON MOORE (WD): Tait and Corbatò have expressed my feeling perfectly. I feel that this proposal may be the subject of a mail ballot, without necessarily waiting until August to decide it. I move that the motion be laid on the table. (The motion to table was carried, 67–35.)

FRANK WAGNER (NA) asked whether the request of the SHARE body to IBM to implement the ALGOL processor of SHARE machines was still in effect. President Cantrell replied that it apparently was. Wagner then moved that SHARE rescind any request made to IBM to implement any ALGOL processors. There was no discussion, and the motion was carried unanimously.”

(Note: The language of the original proposal was strongly intemperate and will not be reproduced here.)

[75] 61 The Rand Symposium, as reported in the 61 Sep issue of
May *Datamation* :

8

“BEMER: . . . No reasonable mechanism for maintenance seems to exist. No one seems to be able to answer the basic question, ‘What is ALGOL?’

WAGNER: . . . It is my opinion that ALGOL will never be a widely used language by programmers in large computing installations outside the universities. It has made its run at the leader and failed. I think it can never muster enough strength for a second run, in the terms in which it now exists. I think, however, . . . that it will perpetuate itself as a language for expressing algorithms. It will exert an influence within the universities and 10 years from now, when people whom it has influenced in the universities are in a position of command within industry, we may then see a successor to or derivative of ALGOL in wide day-to-day use. . . .”

WAGNER: . . . Herb’s (Bright) comment that the creators of ALGOL were not stubborn enough in trying to keep it truly universal . . . is unfair. When they came up against something that wasn’t there, like input–output, or the ability to make tables, or some of the more subtle ambiguities, they had no one to turn to and they had to get their implementation moving along so they had to make a decision. Mr. A made the decision one way, Mr. B made it another; hence we have dialects. . . .

GALLER: As one of the co-authors of one of these dialects, I’d like to explain why we did as we did. We started to write ALGOL 58 for the 704, and we quickly found such things as having to make parentheses do the job of other things. So we found along the way various places where we had to depart from ALGOL 58. We found things like DO and the blank subscript position to be simply unfeasible to put in through a workable translator. Then too, we found several things that we thought were better than the existing ALGOL, and we put them in. . . . When we got all done, what we had simply wasn’t ALGOL . . .

WAGNER: At least you had the decency to call it MAD.

BEMER: I want to defend the ease of using ALGOL. You could take a subset of ALGOL and restrict it in such a way that it would be just as easy to use as FORTRAN. It might be a different form, but these are the choices you make. Roy Goldfinger says that you could, if you wish, start from *Alice in Wonderland* and just by making enough changes write a programming language. . . . You could, if you wish, go the other way. Start with FORTRAN, make a few changes here and there and incorporate the best features of ALGOL. It doesn’t matter. Maybe we won’t get it through the ACM Subcommittee on ALGOL; maybe then the FORTRAN standard will absorb all this. . . .”

CARLSON: . . . One of our engineers decided that people could indeed be trained to use ALGOL and he sat down and wrote an ALGOL primer. Why the people who wrote ALGOL didn’t think of writing a primer to explain all this balderdash, I don’t know. It didn’t take

him very long. . . . We call this the DuPont Publication Language for ALGOL. . . . The fellow who did this work now writes routines in ALGOL, and because he can't put them on a machine with ALGOL, he rewrites them in FORTRAN. He makes the statement over and over that he winds up doing the job in from one-third to two-thirds the total expended time it would have taken him if he did it in FORTRAN in the first place. . . . He is an experienced FORTRAN man to start with. He finds that the ALGOL language takes care of many of the things that he had always complained about the FORTRAN. . . .

BRIGHT: . . . I think people are ignoring the fact that FORTRAN represented a giant step and ALGOL represents a refinement, a generalization, and a maturing. Without the push that FORTRAN got, it could hardly be expected to have such an effect on the industry.

BEMER: FORTRAN wasn't really such a giant step as far as the language was concerned. This had been done by both Rutishauser and Laning and Zierler at MIT many years before. . . . FORTRAN was basically designed as an experiment in object code optimization. . . . It was a laboratory tool for this and I suppose because it was produced by IBM it suddenly got large acceptance.

WAGNER: Remember another thing, though. It was backed up by a very large maintenance group. You could count on the fact that in eight years or so all the errors would have been removed. Maury has a wonderful set of languages in his various NELIAC Processors, but I wouldn't use them even if he rewrote them for the 7090, because I have no assurance that they will be maintained."

- [76] 61 Joint Users Group, Report of Committee on Communi-
May cations:
8 ". . . It was agreed by all present that it would be useful if a study could be undertaken to summarize the efforts that are presently being made to implement ALGOL 60. . . .
Mr. Ed Manderfield . . . suggested that an effort be made to define a subset of ALGOL 60 suitable for implementation on 'small' computers. . . ."
- [77] 61 ACM Editorial Staff Meeting:
May "Need for ALGOL primer and other material to explain the
10 language. . . ."
(Annotation on my copy, signed by one of the "Paris 13"—"ALGOL is like the Bible, to be interpreted and not understood".)
- [78] 61 Minutes of the ACM Council:
May ". . . Bob Bemer reported that the implementation of ALGOL
11 processors was going a lot slower than had been hoped when the original ALGOL language was developed. The Council passed a

motion requesting the President to appoint an Ad Hoc Committee to draft a statement clarifying the current position of the ACM with respect to ALGOL. This draft will be circulated to the Council for approval and if approved will be published.”

- [79] 61 The President of ACM appointed Wagner, Forsythe,
May Wegstein and Bemer to an Ad Hoc Committee “to make a
15 recommendation to the ACM Council relative to the situa-
tion on ALGOL.”
- [80] 61 First Meeting of ISO/TC97/WG E on Programming Lan-
May guages, in Geneva.
18 Following plenary sessions of the International Standardization
Organization’s Technical Committee 97 on Computers and Infor-
mation Processing (also the first meeting), the newly authorized
Working Group E on Programming Languages met under the
chairmanship of R. F. Clippinger, as the U.S. holds the Secretariat.
Following national activity reports, the Working Group decided to
take the first actions on that portion of its scope which read:
“Collect documentation for, classify and catalog existing langu-
ages and their applications.”
- [81] 61 P. Z. Ingerman to the ACM ALGOL Maintenance
May Group, Proposed Alternative to the Oak Ridge Proposal:
31 “The members of this group will adhere to the ALGOL language as
defined in the ALGOL-60 report. Translators should be constructed
in such a way that ALGOL programs that are unambiguously de-
fined by the report will be clearly translated. The committee will
prepare immediately a list of ambiguities at present in the ALGOL
language so that these ambiguities may be avoided by algorithm
writers who prefer quiet to contention. . . .”
- [82] 61 F. V. Wagner to “Those Concerned With Implementing
Jul ALGOL For Computer Manufacturers”:
20 “. . . The National Council of ACM believes that it is important for
it to review and clearly define its present policy in connection with
ALGOL. I have been appointed chairman of a committee whose
function is to draw up a proposed statement of policy for the con-
sideration of the National Council. It is important that this com-
mittee be aware of the present plans of all computer manufacturers
for providing ALGOL processors for their various machines.
The Committee would appreciate it very much, therefore, if you
would assist them in their task by sending to each member of the
committee, listed on Enclosure (1), the following:
- (a) A formal statement as to your company’s plans for providing
ALGOL processors. . . .
 - (b) Any written material which defines as thoroughly as possible
the *exact* form of input language that would be acceptable to
those processors, and its meaning to those processors.

- (c) Your opinions as to the strong points and deficiencies of ALGOL, both from the point of view of the *user* of the language as well as the system programmer who is designing processors to accept it. In addition, if you have any opinions as to the policy that the ACM should follow, or action that it should take, we would be interested in knowing about them. . . .”
- [83] 61 H. R. J. Grosch, in *Datamation*:
Jul “... But the various ALGOL groups ought to agree on just one thing, just once, and head for the Elephant’s Burial Ground. . . .”
- [84] 61 RCA to Members of the ACM ALGOL Maintenance
Jul Group:
19 “We support the sentiment expressed in the Oak Ridge proposal . . . we request the chairman to call for a vote on the above mentioned proposal.”
- Membership:
- | | |
|--------------------------------|--------------------------------|
| Armour Research Foundation | Princeton University |
| Bendix Computer Division | Remington Rand Univac |
| Burrughs—Electrodata | System Development Corporation |
| University of Calif., Berkeley | Stanford University |
| Case Institute | Sylvania Electric |
| University of Chicago | Computer Associates |
| Georgia Tech | RCA |
| Lockheed Aircraft | Carnegie Tech |
| National Bureau of Standards | University of Mainz, Germany |
| U.S. Naval Electronics Lab. | Argonne National Laboratory |
| University of North Carolina | Royal McBee Corp. |
| Northwestern University | DuPont |
| Oak Ridge National Laboratory | IBM |
| University of Pennsylvania | Dartmouth College |
- [85] 61 Jean Sammet of Sylvania voting NO on Oak Ridge Pro-
Jul posal:
28 “... problems do not disappear just because they are ignored. I consider the most objectionable sentence in the Oak Ridge proposal to be the one stating: ‘For several years to come this committee will not propose any changes or additions to the ALGOL language.’ This seems to negate the very purpose of having a Maintenance Committee . . . either a problem exists or it doesn’t, and in the former case it should be solved. . . . It must be emphasized that there is a difference between doing things slowly and carefully and not doing them at all. The ALGOL Maintenance Committee seems to be heading in the latter direction, whereas it could so easily be taking the steps which are necessary to improve the usage and acceptance of ALGOL as a universal language.”

- [86] 61 Computer Associates voting NO on the Oak Ridge Proposal:
Aug 2
“... We agree with Ingerman that ‘anything which is ambiguous is undefined’ is an unsuitable answer to the ambiguities of ALGOL 60. . . .”
- [87] 61 H. Rutishauser, in the *Automatic Programming Information Bulletin*:
Aug
“... I must recall that ALGOL is not just a programming language, but an internationally accepted standard notation, for which any change has rather severe consequences. . . .”
- [88] 61 J. H. Wegstein’s “ALGOL 60—A Status Report”, published later in the 61 Sep issue of *Datamation*:
Aug 7
“... This report was written in response to recent intimations that ALGOL is or should be on the wane. One is reminded of Mark Twain’s response to rumors that he had died. ‘The reports of my death have been greatly exaggerated.’
Physicists define momentum as equal to mass times velocity, and it is impossible to estimate the momentum of an object by observing only its velocity. A very massive object may have a large momentum even though it is moving very slowly. Similarly with ALGOL, the momentum of the movement cannot be judged by the speed with which the language is being put into use without also observing the number of people who are working with it.
At this time, the future widespread use of ALGOL for publication and teaching purposes seems certain. It is rather easy to translate by hand from ALGOL into various computer languages or into other artificial languages similar to ALGOL for which compilers now exist. The permissibility of many hardware languages that are only similar to the ALGOL publication language may be essential to giving the publication language a foothold. Yet, as time goes on, the urge to ‘stand closer to the trough’ will surely lead to compilers which bring the computer very close to the ALGOL publication language.”
- [89] 61 IBM Reply to the Wagner Questionnaire:
Aug 14
“A. IBM expects to supply, at some future time, processors that accept languages of the ALGOL class for such of its machines that it may be practical. We do not wish to make premature disclosures, but we may say that we are pursuing several compatible approaches—including the following, about which you are familiar:
1. Improvements and modifications in the FORTRAN language to incorporate the new and desirable features of ALGOL. These are reflected in the specifications for a 7090 processor.
2. Experimental investigation and study of the properties of such languages and their translators.”

3. Cooperative participation in the SHARE/ALGOL committee. Our main contribution so far has been the experimental processor for the 709/7090 of about 18,000 instructions.
4. Participation in the ALGOL 60 maintenance group chaired by Mr. Joseph Wegstein.

B. No written materials are available other than the documentation furnished to the SHARE/ALGOL Committee.

C. We feel that the strong points of ALGOL are self-evident and that the deficiencies have been adequately noted in:

1. The *ALGOL Bulletin*, Copenhagen.
2. The *Communications of the ACM*.
3. The notes of the ALGOL 60 Maintenance Committee.”

[90] 61 Letter from R. W. Bemer to I. L. Auerbach, President of
Aug IFIPS:

15 “... IBM’s feeling that the maintenance of ALGOL should be undertaken at an international level reflects the curious impasse facing the ALGOL 60 maintenance committee. The rules of this committee are such that a negative vote of 10% or more is sufficient to defeat a resolution. Accordingly, the present resolution is defeated. However, if a proposal to make a specific change in ALGOL were submitted to the committee, the members now voting against changes in ALGOL (a majority, although not enough to pass the resolution) would constitute a body of more than 10% required to defeat a proposal of this type. Thus the committee finds itself, as a result of this vote, in a curious position. IT CAN’T CHANGE ALGOL and IT CAN’T *NOT* CHANGE ALGOL. This conclusion was confirmed by Mr. J. Wegstein in a phone conversation with me.

Since this committee, by all laws of logic, can produce only zero output, it would seem that an appropriate international committee with authority is necessary to maintain the language. In Mr. Utman’s letter to you, on behalf of the secretariat of Working Group E of TC97, he stated that both Tootill and I did not mention specific IFIPS interest in programming languages at the Geneva meeting. I think this position was correct as we were not instructed to do so, and indeed your reply to Utman supports this. However, the original sponsors of ALGOL are now components (in one form or another) of IFIPS and you might find it necessary at some future time to re-evaluate the IFIPS position. . . .”

[91] 61 IBM voting NO on the Oak Ridge Proposal:

Aug “We feel that the ALGOL language should be maintained. However,
16 we would wish such maintenance to be carried on by a unified international committee sponsored by an authoritative international body such as IFIPS or ISO.

Our vote is based on the fact that no such international body exists with the authority to maintain ALGOL. . . .”

- [92] 61 Minutes of SHARE XVII—Motion to Withdraw Support
Aug ALGOL:
23

“The question of ALGOL 60 was re-introduced by Mort Bernstein (RS), who moved to call from the table and amend slightly his ALGOL resolution made at SHARE XVI. The effect of this resolution would be to withdraw the support of SHARE, as a body, from the ALGOL effort and to notify the ACM of this. . . .

Bernie Rudin (ML) pointed out that as a result of recent work, ALGOL was more nearly complete than the resolution would indicate; nevertheless, he said, the ALGOL Committee would have no real objections to the proposed letter. Frank Wagner (NA) stated that, as chairman of an ACM Committee to study policy on ALGOL, he was no longer permitted a personal opinion; however, he suggested that a paragraph be added which would take account of the recent developments in ALGOL. J. A. Buckland (SO) felt that the letter was incomplete and inaccurate, and F. J. Corbato (MI) objected that it was gratuitous and could place SHARE in a false light in the eyes of non-members. Aaron Finerman (RF) reminded the body that it had endorsed ALGOL three years earlier and that the intent of the letter was to inform the ACM that SHARE no longer approves ALGOL wholeheartedly.

The motion was put to a vote and carried, with 65 installations in favor, 43 against, and 15 abstaining.”

- [93] 61 Letter from the SHARE President to the President of the
Aug ACM:

“In September 1958, at the 11th meeting of SHARE, a resolution commending the efforts of the ACM-GAMM IAL Committee was unanimously approved and SHARE adopted ALGOL as a language for SHARE machines. SHARE prevailed upon the vendor of its machines to produce an ALGOL processor under the direction of the SHARE ALGOL Committee. In the next year the SHARE ALGOL Committee proposed a number of extensions to ALGOL, and recommended to ACM that a mechanism be established for the recognition of the continued development and extension of ALGOL for the purpose of establishing standardization among all computer users.

By 1960 enthusiasm for ALGOL within SHARE had begun to wane, and the work of the ALGOL Committee was frustrated by apathy. The Committee was reorganized at the 15th meeting of SHARE, with only those members pledged to work on ALGOL implementation remaining. The goal was set to produce an ALGOL processor for the 709/7090 by September 1961. In six months, this effort also failed to make any significant progress.

With this background, at the 16th meeting of SHARE, a resolution was passed which withdrew SHARE'S previous request that IBM produce an ALGOL translator for SHARE machines. Among the reasons for this action were the following:

1. It has been impossible to generate sufficient enthusiasm for ALGOL within SHARE to ensure its implementation on SHARE machines.
2. The SHARE ALGOL Committee has reported that ALGOL 60 seems to be incomplete, ambiguous, and difficult to implement in its entirety, and that there does not exist an effective way of resolving the troublesome issues.
3. The ALGOL dialects which have resulted from various attempts at implementation on several different non-SHARE machines, while being ALGOL-like, still do not retain the compatibility of source language which it was hoped ALGOL would achieve.
4. FORTRAN has become a generally accepted and well known algebraic system for which processors exist on SHARE machines, as well as many other computers.

While hereby acknowledging the inability of SHARE to obtain a working ALGOL 60 processor as a successor to FORTRAN, this is done without prejudice to the efforts of those members of SHARE who wish to continue to experiment with, develop and implement ALGOL 60.”

- [94] 61 J. H. Wegstein, Chairman, to the Members of the ALGOL
Aug 60 Maintenance Group: Vote on the Oak Ridge Resolu-
28 tion:

“... Since more than 10% voted *no*, and less than 70% voted *yes*, the motion does not carry. However, one might observe that by the same rules, as long as those who voted *yes* do not change their minds, no changes to ALGOL are likely to be accepted.”

Actual vote—16 for no change, 10 for OK to change, 2 missing.

- [95] 61 ALGOL Maintenance Group Meeting, in Los Angeles.
Sep
5

- [96] 61 Minutes of the ACM Council:
Sep
8
- “... Frank Wagner presented the report of the Ad Hoc Committee on ALGOL. After reviewing the history of ACM’s participation in ALGOL, he reported that the committee had sent letters to the larger manufacturers and users’ organizations. The replies to these letters showed that the manufacturers varied between those who were extremely enthusiastic to those who were taking no announced action at the present time. After considerable discussion, the following resolution was passed:

‘BE IT RESOLVED that the Council of the ACM adopt the following policy with regard to ALGOL and direct that it be published in the Communications of the ACM:

1. The ACM supports ALGOL 60 as the preferred publication language for appropriate algorithms.
2. The ACM continues to encourage research into development and evaluation of languages for publication and programming.

3. The ACM believes that ALGOL 60 is a language worthy of consideration by national and international standardizing bodies.’ ”

[97] 61 Working Conference on Automatic Programming Methods, in Warsaw.
Sep
5-13 Attended by about 60 representatives from the Soviet Union, Czechoslovakia, German Democratic Republic, Hungary and Rumania.

[98] 61 News item in *Datamation*:
Oct “IBM’s ALGOL is not available: Posted on the bulletin board at the recent ACM conference in Los Angeles was a listing of all compilers presently completed, their completion dates, and the machines for which they were prepared. The tabulation was presented and posted by IBM’s Bob Bemmer and included the attention-getting fact that an ALGOL processor for the 7090 was completed by IBM as of December, 1960.

Although this was assumed by many registrants as an announcement of availability (although indeed, a curious one), this is not the case. The processor which was prepared and listed as completed was written on an internal, experimental basis for educational research only. It is likely that if an ALGOL processor was developed for IBM users, it would not be this one.

However, field testing of this ALGOL processor will take place by a number of SHARE ALGOL committee members early next year. And while testing is hardly to be considered an IBM endorsement of ALGOL or the outdating of FORTRAN, progress in this direction is interesting to note in view of the following excerpt:

In the March 1961 issue of the Computer Bulletin, publication of the British Computer Society, an article on ‘Survey of Modern Programming Techniques,’ by R. W. Bemmer was published and we quote in context from p. 130: ‘I have enough faith in the eventual future of ALGOL to have caused a program to be constructed which converts from FORTRAN source language into a rather stupid ALGOL. I have been asked many times why we did not make it translate from ALGOL to FORTRAN so that the existing processors could be utilized. The answer has always been that we wish to obsolete FORTRAN and scrap it, not perpetuate it. Its purpose has been served. . . .’ ”

(One could of course note that this talk to the BCS was given in 60 September, at which time SHARE had not convinced IBM to change its ALGOL policy—or that the survey was done for the ISO/TC97, . . . or that we were speaking of poor processors which should be improved—in any case, it’s an easy start on the road to the Research Division.)

- [99] 61 C. J. Shaw, in *Datamation*:
 Oct “JOVIAL is a procedure-oriented programming language derived from ALGOL 58 and designed by the System Development Corporation for programming large computer-based command/control systems. JOVIAL is largely computer-independent; compilers for the IBM 709/7090, the CDC 1604, the Philco 2000, the AN/FSQ-7 and the AN/FSQ-31 are currently in operation or in check-out. . . . This flexibility is due to the fact that JOVIAL compilers are written in JOVIAL, in a computer-dependent and, to a lesser extent, system-independent form. . . .”
 (JOVIAL is an acronym for Jules (Schwartz) Own Version of the International Algebraic Language. A very complete historical paper is the entire content of *APIB* 22, 64 Aug, again by C. J. Shaw.)
- [100] 61 Meeting of the IFIP Council, outside of Copenhagen:
 Oct An unanimous vote authorized a Programming Languages Committee, TC 2. The Council was to suggest candidates for the Chair. 23-25 (Dr. H. Zemanek of IBM Vienna was named.)
 (From my notes: Bauer said that ALGOL was a product of a combined effort of representatives of technical societies and the language has status for this reason only. van Wijngaarden said that such a language has status only by general acceptance. I then submitted the hypothetical case of someone publishing, under the auspices of one or more technical societies, a revision of ALGOL as a new language specification. I asked if this would be proper and would such a language replace ALGOL if it got equivalent or greater acceptance (I just happened to have the specs for ‘IBM ALGOL’ with me)? There seemed to be a general feeling that this was not quite a cricket thing to do. . . . Bauer and van Wijngaarden were in agreement in their insistence that only the thirteen original authors could re-issue or legally modify ALGOL. . . . Bauer, on the basis that my English was better than his, asked me to write a draft letter to the original authors of ALGOL . . . this was tested, in the writing, with van der Poel. . . . An informal group met on Tuesday . . . to consider the next steps. By this time there was considerably more understanding of IBM’s position and what could be done. . . . It was at this time that van Wijngaarden had a flash of perception about software penalties and lack of rental being a major problem to any computer manufacturer. There seemed to be a general feeling that the clean-up effort should be made in order that IBM could become an active aid in the ALGOL movement. . . .”
- [101] 61 R. E. Utman, in *Datamation*:
 Nov “. . . specifications have been found ambiguous or impractical of achievement. In this condition they permit such varied interpretations that some of the resultant processors can hardly qualify to carry the names ALGOL or COBOL. Yet they are being labelled and sold as such. . . . This need in information processing was recognized in 1960 by ASA, and the responsibility for programming languages established within the scope of Sectional Committee X3 and its

Subcommittee X3.4. Under the Chairmanship of Dr. J. Chuan Chu, a year of education and experience has since accrued and significant progress can be reported today.

The first thing the programming experts in X3.4 believe they have learned is that the problem of standardizing a language seems several orders of magnitude more complex than that of a unit of measure, a railroad gauge, film size, etc. . . . As in every field of technology, a standard must be dynamic and maintained in order to be realistic, useful, and accepted. . . . Once the standard language is achieved, it will then be necessary to specify tests to be used in qualifying the variety of interpretations that will be labelled and sold in its name. There must be an organized discipline of some sort to enforce evaluations by these tests, and to administer a continuing program of certification. . . .”

[102] 61 F. L. Bauer and K. Samelson to the Authors of the
Nov ALGOL 60 Report:
30

“Nearly two years have elapsed since the issuance of the ALGOL 60 Report. Processors (translators) have been written for many machines during this period, resulting in many advances in translation methods and considerable experience in the actual writing of such processors. In addition, there now exists some experience in using ALGOL for the machine solution of problems and even more experience in the communication of algorithms in the publication language. Thus the overall acceptance of ALGOL, as a language for scientific problems, has been good, and especially favorable in Europe.

However, some people claim that there are some obstacles to the general acceptance of ALGOL. Indeed the ALGOL Bulletin and various working groups have served as a forum for discussion and suggestions of interpretation, revision and extension. None of these methods have proved sufficiently effective against minor variance in both language usage and processor interpretation, possibly caused by the report and not due to deliberate intention.

It has been suggested that some minimum amount of resolution is necessary and that the most effective (and at present the most authoritative) means of doing this is the reconvening of the original committee, as discussed at the end of the Paris meeting. Therefore we request you to consider your participation in such a meeting and to secure the acceptance of your attendance from your sponsor.

It has been suggested that an original member may not be deeply concerned with ALGOL now and therefore may not wish to participate. Although participation is not mandatory, it would be helpful to have a letter of resignation so that the authority of this body is not diminished.

Furthermore, it might be desirable to invite a few additional members who are acknowledged, practicing experts. It has been indicated that it may be highly desirable that a conference member may be accompanied by a technical advisor to him. In this way, some

processor implementors can be brought into useful contact with the conference.

The meeting should occupy three days, starting Monday 2nd April 1962, immediately after the ICC Symposium on Symbolic Languages in Rome . . .”

- [103] 61 Date of internal report “IBM ALGOL—a revision and
Dec modification of the ALGOL 60 Report due to an ad hoc
5 IBM committee. . . .”
- [104] 61 P. Naur to the authors of the ALGOL 60 Report:
Dec
8 “In reply . . . I can say that I agree that the time is ripe for a removal of ambiguities and omissions in the ALGOL 60 Report. However, I regret that I cannot at present support the suggestion of settling these questions through a meeting of, essentially, the original committee. . . .
The formation of the U.S. Maintenance Committee and the result of the enquiry of the ALGOL Bulletin, particularly the unchallenged conclusions AB 11.1.6, make this approach impossible as far as I am concerned, at least at the present.
I would like to add that I have already for some time been working on a different approach to this problem . . . the first step . . . is the distribution of a detailed questionnaire in the ALGOL Bulletin. . . .”
- [105] 61 K. Samelson and F. L. Bauer to the authors of the
Dec ALGOL 60 Report:
13 “. . . We therefore consider Peter Naur’s material as a very useful contribution to the list of suggested topics, but stand to our request from Nov. 30 of a meeting of the original committee.”
- [106] 61 News item in *Datamation*:
Dec “Frankly acknowledged by many IBMers as a far superior processor to FORTRAN, ALGOL development is nevertheless far from practical in the eyes of IBM management. The problem is not one of money but largely the lack of experienced programmers to meet present commitments for over 35 FORTRAN processors as well as numerous other dialects promised to IBM customers. In addition, scrapping their present investment in FORTRAN would involve an enormous risk for IBM with no national or international body providing the needed authority for a definitive explanation of ALGOL. . . . The current status at IBM: considerable head-scratching.”
- [107] 61 D. D. McCracken, in *Datamation*:
Dec “. . . I think it’s time somebody spoke up for the power of ALGOL in doing ‘ordinary’ programming—the kind of work in which recursive definition, ‘own’ variables, and call-by-name seldom arise. . . .

It is interesting to speculate on the origin of the myth of ALGOL's abstruseness, for which I suggest three reasons. First, the report . . . is excellent for its intended purpose of defining the language, but somewhat lacking when viewed as a beginner's primer. . . . Second, most of the published discussion of ALGOL has centered around the advanced features, which is entirely reasonable, but misleading . . . this leaves those of us on the fringes with the entirely mistaken impression that ALGOL consists only of the difficult things. Third, the algorithms published in the *Communications* are slow going for some of us *because the problems they solve* are slow going for some of us . . . in the process of exhibiting how ALGOL can be used for difficult problems, some of us got the impression that that was the whole story.

In summary, it appears to me that ALGOL offers clear-cut advantages to anyone doing scientific computing, whether or not the application requires use of the more advanced features of the language. These features may well turn out to be major advances in the computing art; in the meantime, there is no need to wait for the dust to settle before making use of the 'simple' advantages. . . . It's time for some of us to take a fresh look."

- [108] 61 Minutes of the ACM Council:
Dec "Resolved: That the ACM request AFIPS to request IFIPS to
14 reconstitute the ALGOL Maintenance Committee under the
auspices of IFIPS."

- [109] 62 K. Samelson to P. Naur and members of the ALGOL 60
Jan Committee:
5 "... For the real crux of our problem is to convince the leading
computer manufacturer(s) to incorporate ALGOL processors in the
programming systems they provide for their products. This requires
a clearcut unambiguous language presented with clear authority.
If this is not available some manufacturers will continue to give
their own interpretation to ALGOL. Others will continue to be
disinclined to incorporate ALGOL in their programming systems,
and the story of SHARE ALGOL indicates that no exercise in
group dynamics will change that. . . ."

- [110] 62 Issuance of *ALGOL Bulletin* No. 14, containing the Naur
Jan Questionnaire.
12

- [111] 62 D. D. McCracken, in *Datamation*:
Jan "... Despite its demonstrable advantages as a computer language,
ALGOL will gain acceptance slowly (but steadily). Acceptance
would be much more rapid if users were willing to believe that (a)
ALGOL has not already been engraved in granite, never to be
changed, and (b) it will not change so drastically every two years
that processors will be continually obsolete. It would also help,

of course, to hear a little more enthusiasm from the direction of White Plains. Maybe we will have to wait for FORTRAN to evolve into ALGOL, as it already appears to be doing. . . .”

- [112] 62 F. V. Wagner, in *Datamation*:
Jan “... For general purpose work, FORTRAN will continue to maintain its supremacy. It will have little competition, except in universities, from any of the ALGOL variants. . . . Thus we can look for an increased pressure for the incorporation into FORTRAN of features permitting the easy development of special-purpose POL's within the FORTRAN system. If FORTRAN does not rise to meet this challenge, it is possible that the pendulum may swing to one of the dialects of ALGOL. JOVIAL is the most likely candidate. . . .”
- [113] 62 A. J. Perlis, Chmn., ACM Programming Languages Committee, to the Authors of the ALGOL 60 Report (American Delegation):
Feb 15 “... The revision of the report is quite important for political, as distinct from practical, reasons. It is important that the American delegation do their part in aiding the adoption of ALGOL as a computer language by at least removing any impediments due to ambiguities within the ALGOL 60 report.
Thus, will you please inform me at the earliest possible time of your intent to attend the meeting . . . or send me a letter of resignation from the Report Committee. . . .”
- [114] 62 J. H. Wegstein to the Authors of the ALGOL 60 Report:
Feb 19 “... Although a declared international standard may be years away, nevertheless questions are being asked of ALGOL and its ambiguities. From a practical point of view, I think that ALGOL 60 could be used as it is for two or three more years. From a political point of view there needs to be a ‘flawless’ ALGOL and an organized ALGOL supporting group. . . . Let us see if errors can be corrected, results can be accepted, and set the course for establishing a permanent ALGOL maintenance group.”
- [115] 62 B. A. Galler to the Editor of *Datamation*:
Feb “One of my colleagues has pointed out to me that the best argument one could give for switching from FORTRAN to MAD, ALGOL or BALGOL is the cover of the December issue. The simple iteration pictured in all four languages is correct in MAD, ALGOL and BALGOL, but in FORTRAN we find not only a mixed expression, but incorrect formation of the ‘DO’ statement (for the iteration desired).”
- [116] 62 Prof. T. A. Gallie, Jr., to W. C. Hume, Pres., IBM Data Processing Div.:
Feb 21 “... IBM took an active part in the birth of ALGOL. . . . Applied Programming is having trouble making FORTRAN work on some

computers (such as the 7070) and hence is hesitant to tackle ALGOL. Duke University has written and is happily using an ALGOL compiler for the IBM 7070. We much prefer this language to FORTRAN and our translator is many times faster than Applied Programming's basic FORTRAN compiler which, in turn, is many times faster than their full FORTRAN compiler. On the other hand, our object programs are probably half as fast as those produced by FORTRAN and therefore of no use to many FORTRAN users. However, we would like to make ALGOL available to the many 7070 customers . . . who have told us they want it.

The problem is that IBM can't decide what card punches should be assigned to a few additional characters. . . . More precisely, we want one 026 printing keypunch with a few extra characters which *have IBM's blessing*, so that other IBM customers will eventually rent similar keypunches and possibly use our ALGOL translator. . . ."

[117] 62 W. C. Hume to Professor T. A. Gallie, Jr. :
Mar 9 "I should like to take this opportunity to congratulate you on your ALGOL compiler for the 7070 and to assure you that we consider it to be in IBM's interest for the ALGOL language to be implemented as quickly as possible. . . ."

[118] 62 First Meeting of IFIP TC 2, Programming Languages, in
Mar Feldafing (Munich):
20-21

1. The scope of the committee shall be to promote the development, specification, and refinement of common programming languages with provision for revision, expansion and improvement.
2. The specific program of work shall include:
 - (a) General questions on formal languages, such as concepts, description and classification.
 - (b) Study of specific programming languages.
 - (c) Study and if appropriate coordinate the coalescing of a new programming language for which there appears to be a need.
3. The Technical Committee may request the establishment of working groups if and when appropriate.
4. The Technical Committee shall establish and maintain liaison with other appropriate international organizations.

.....

1. A working group may be established by the Council of IFIP upon the request of a Technical Committee. It is a group of technical experts selected without consideration of nationality and assigned to work in a specified technical area.
2. The membership of a working group is appointed by the chairman of the corresponding Technical Committee with the approval of this Technical Committee. Membership is not restricted to persons who belong to IFIP member societies or groups of societies.
3. The chairman of the working group is appointed by the President of the Council with recommendation from the Technical Committee.

4. Publication of results in the name of the working group can be made after having been reviewed by the Technical Committee under the provision that explicit mention will be made of the fact that it will be submitted for approval at the next Council meeting. After this approval it becomes an official IFIP publication."

Working Group 2.1 on ALGOL was established under the chairmanship of W. L. van der Poel:

"The working group will assume the responsibility for the development, specification and refinement of ALGOL."

D. D. McCracken, writing in the 62 May issue of *Datamation*:

"ALGOL has a home. . . . This is indeed important news to anyone interested in the acceptance of ALGOL, since one of the main obstacles to its adoption has been its homelessness. Until now, no one could really speak for ALGOL with complete authority except the 13 authors of the original report and they were not in the language-maintenance business. Now there will be an official body to which questions, suggestions, and complaints can be directed, with assurance that a response will be forthcoming and that it will be official policy. . . ."

- [119] 62 Symposium on Symbolic Languages in Data Processing,
 Mar in Rome, sponsored by the International Computation
 26-31 Centre (UNESCO) with published proceedings:

D. D. McCracken, reporting in 62 May issue of *Datamation*:

". . . Condensed to essentials, the argument ran: 'We've got a lot of customers who need *answers*, not speculation. We would be happy to use ALGOL, since it seems to have many good features, but we can't do much with a compiler that is loaded down with these miserable recursive procedures and which produces horribly inefficient object programs. We want to *work* with ALGOL, not *play* with it.' There was loud, sustained applause.

Four viewpoints could be identified in the ensuing discussion. Some one said: 'But I've got a compiler that isn't slowed down by recursiveness, and the object programs are pretty good. You've just got to learn how to write compilers.' Somebody else said: 'Maybe recursiveness does cost time in some cases, but it costs *not* to use it when it is the best solution. You've just got to learn how to use this new tool we've provided.' Another said: 'Even if recursiveness is difficult and often not useful, the idea of ALGOL for standardization is so important that some compilers should be constructed without recursiveness, if necessary. You've got to provide us with more than one version of ALGOL.' Finally, someone said: 'ALGOL is such a large advance in the computing art that we never should

have expected immediate acceptance. We've got a lot of things to learn before ALGOL is widely accepted, as it surely will be in time, and one of these is patience.' . . ."

(The proceedings of this symposium contain verbatim records of the panel discussions, all of which will be very interesting to the new worker in this field. I doubt if there will be many advances by 1975 for which the germ of the idea cannot be found herein. This quandary must be resolved by referencing, not actually duplicating in this log, although many of the comments noted are more important intrinsically than many of the elements of this log.)

- [120] 62 Continuation of the first meeting of IFIP TC 2. ALGOL
Mar Working Group 2.1 authorized, in Rome.
27
- [121] 62 Meeting of the ALGOL 60 Report Committee, in Rome,
Apr resulting in the Revised Report.
2-3 Approximately 30 minor changes were agreed. Basic input were the results of the questionnaire in *ALGOL Bulletin* 14 and proposals and ambiguities described in that publication and the Communications of the ACM. Incorporated in the report was their acceptance of transfer of responsibility for the language to IFIP WG 2.1.
As it turned out, 8 of the original authors participated, 1 direct representative of an original, 6 advisers and 1 observer; the last being van der Poel, who had to take over the responsibility for IFIP.
Two major disagreements were noted. Naur, van Wijngaarden and van der Poel were in favor of no distinction between procedures and functions, together with the concept of body replacement in the procedure definition. Opposed were Bauer, Samelson, Green and Kogon.
- [122] 62 Conference on Advanced Programming Languages for
Apr Business and Science, at Northampton College, London.
17-18 Proceedings published in the *Computer Journal*. Some excerpts from the discussions:
"A. GEARY: . . . My first pleasure is to introduce Dr. Dijkstra. . . . We have warned him that there has been a certain amount of bias against ALGOL in England, in some quarters. . . .
G. M. DAVIS: . . . We might also agree on the standardization of means of specifying and describing languages. Until this is done one cannot start the standardization of languages themselves. . . .
M. V. WILKES: . . . It will in the future be useful to know exactly what is meant by a given programming language. . . . But to suggest that standardization should mean the selection of one particular language to be used on all occasions, in preference to all others, appears to me to betray a very superficial knowledge of the subject. . . ."

E. W. DIJKSTRA: . . . The main virtue of recursive procedures is that they make the tool more lovable for computers. A few weeks ago somebody used the phrase ‘ALGOL playboys’ in a nasty fashion, and I was very angry. A Dutch philosopher wrote a big book called *Homo Lucidas*†—the plain man—showing clearly that everything which, ages later, was regarded as of some significance, had started off as being 100% plain. . . .”

†(Note: M. Halpern suggests that the transcript was not verified by the participants, and that the book was in fact *Homo Ludens*—The Playing Man. The last word would thus be “playing”.)

- [123] 62 Invitations for Membership in IFIP Working Group 2.1,
Apr ALGOL, tendered by Prof. H. Zemanek, Chairman of
24 IFIP Technical Committee 2, Programming Languages.
- [124] 62 G. E. Forsythe to the ACM Editorial Staff:
May “. . . It was agreed that the ALGOL movement has progressed to
7 the point where it is no longer desirable to publish unrefereed algorithms. Perlis stated that beginning with 1963 the algorithms will be refereed . . . Perlis formulated the following policy:
- a. The Communications will publish codes in any language as part of a refereed article.
 - b. In the Algorithms section the codes must be in ALGOL (or COBOL?)”
- (This answered some pressure from SHARE to publish algorithms in FORTRAN.)
- [125] 62 ISO/TC97/WG E meeting, in Stockholm, courtesy of the
May Swedish Standards Commission, Olle Sturen, Director.
9–10 Survey of Programming Language Processors presented as (USA–10)55, 7 pp. Later published in *CACM*, 63 Mar.
- [126] 62 One week Symposium at the London School of Economics.
Jul Proceedings published as—Wegner, P. (Ed.) *An Introduction to Systems Programming*, Academic Press, 316 pp.
- [127] 62 Meeting of U.S. Participants in IFIP WG 1, in New York
Jul City.
10 It was agreed that there was no need for independent formulation of a U.S. position.
- [128] 62 *Datamation* interviews W. C. Hume and A. L. Harmon
Jul of IBM:
“Q: . . . the American Standards Association, the Association for Computing Machinery, and the International Federation of Information Processing Societies, as well as several other manufacturers, have advocated the implementation of ALGOL. What is IBM’s position?”

HUME: May I ask a question? What's the stand of GUIDE and SHARE who are the major machine users?

Q: In support of FORTRAN.

HUME: And logically, because they have a tremendous investment. I think one of the successes of IBM has been based on the fact that we try and service the investment of our customers. That's number one. These are the major users of the machines. Secondly, I somehow feel that there is a wrong impression as to our support of ALGOL. We are not ignoring ALGOL. We're really taking a look at it and, over and above a look, we're putting a tremendous investment in ALGOL. Some people have the feeling that just because we're continuing FORTRAN with the investment that our customers have in it and since GUIDE and SHARE have come out for FORTRAN, that we're against ALGOL. We're not against it. We're simply saying that we have to support FORTRAN.

Q: By investing in ALGOL, do you mean research into the development of an ALGOL processor?

HUME: Yes.

Q: Will it be announced soon?

HARMON: As you know, ALGOL and its specifications are still under development and we have submitted an experimental ALGOL processor to the SHARE ALGOL committee for further development and work. We like to make sure that things are reasonably cleaned up before significant assets are poured into any program.

Q: Regardless of an announcement date of an ALGOL processor, would this signify the end of FORTRAN maintenance and development?

HUME: It would not.

Q: With this fact in mind, would you be able to provide a prediction as to when an ALGOL processor might be forthcoming from IBM?

HARMON: You're in an area where you're almost asking when something will be invented. In a development program, it's extremely difficult to forecast even close to when something will be specified to the level where it can be properly implemented. My guess would be that the next five years will show significant changes, not only in the ALGOL effort, but also in the FORTRAN language itself. It's conceivable that these two will marry. . . ."

[129] 62 News item in *Datamation*:

Aug "The winner in a hotly contested language wrestling match is . . . JOVIAL, at least as far as the U.S. Navy is concerned. . . .

The JOVIAL adoption is opposed by NELIAC advocates who contend that their language was originally designed for the Navy and could be used more easily by personnel of less experience than would be required for JOVIAL. In addition, a recent study . . . indicated much faster compiling and executing speeds for NELIAC over JOVIAL."

(Comment: ALGOL variant A vs. ALGOL variant B.)

- [130] 62 Meeting of IFIP TC 2 (second meeting), in Munich.
 Aug
 25
- [131] 62 IFIP Congress 62, in Munich. Reported in 62 Oct *Datama-*
 Aug *tion*:
 27– “... In virtually all respects, IFIP was a programming-oriented
 Sep conference. Papers on hardware, circuit design, advanced
 1 components, etc., drew the smallest attendance while sessions on
 ALGOL, artificial intelligence, information retrieval were presented
 to capacity audiences. ... The interest of Europe in ALGOL was
 exemplified by numerous signs accompanying equipment exhibits
 and, of course, in frequent conversations throughout the Congress.
 In Europe, FORTRAN is generally viewed as ‘that other langu-
 age’...”
- [132] 62 First meeting of IFIP Working Group 2.1 on ALGOL, in
 Aug Munich. R. F. Clippinger reporting in *Datamation* their
 28–30 plans to:
- a. to propose ALGOL 60 as an international standard,
 - b. to define I/O conventions for ALGOL 60,
 - c. to define an ALGOL 60 subset.”
- D. W. Hooper, President of the British Computer Society,
 in his annual report, published in the 62 Dec issue of the
Computer Bulletin:
- “... ALGOL 60 in its final international official version, including
 certain minor amendments, will be published in any country that
 wishes in this next few months. At one of the sessions the United
 States delegate stood up and publicly apologised for the lack of
 interest taken by America in ALGOL. ... The United States are, of
 course, now full members of the IFIP Subcommittee which is now
 taking over ALGOL. ... I expect the next full meeting will probably
 be about November to start on the revised edition of ALGOL
 which is ALGOL (60 + X) because we do not know the year. We
 have full American participation and support and this will pull
 ALGOL more into line with American thinking.
- Outside official IFIP circles, it is my impression, and I would not
 for the moment put it any stronger than that, that in about 1969 or
 1972 there will be the third edition of a standard language which
 will, if you like, overtake ALGOL, FORTRAN and all the lot. ...
 There is at the moment strong international feeling that there must
 be one language, that ALGOL has served a purpose; it can still
 continue to serve a purpose, and I think it is certain that any future
 standard language can always look back to ALGOL as its honourable
 ancestor. ...”

- [133] 62 Third meeting of ISO/TC97/WG E on Programming
Oct Languages, in Paris.
9-13
- IFIP invited to present a specification of ALGOL 60 (Rome version) and a proper subset for consideration as international standard programming languages. IFIP then submitted the official IFIP ALGOL and agreed that a subset specification would also be submitted, if and when completed.
- The U.S. submitted a position paper, ISO/TC97/WG E (USA-19) 80:
- “The recommendations below are submitted in anticipation of the possible proposal . . . that consideration be given to adoption of ALGOL 60 (Rome), recently approved as an IFIP official language, as an international standard language or ISO Recommendation. . . .
- A. ISO/TC97/WG E should be concerned with ALGOL 60 (IFIP) as a potential programming language standard, and not merely as a publication language.
 - B. ALGOL 60 (IFIP) should not be considered acceptable as a Proposed Standard Programming Language without provision for or resolution of the following:
 - 1. Input-output facility. . . .
 - 2. A standard subset. . . .
 - 3. . . . the five problem areas of ALGOL 60 (Rome) should be resolved by IFIP/WG 2.1. . . .
 - C. A means should be provided to determine whether or not an implementation satisfies the standard.
 - 1. . . . a set of test programs, with a description of their behavior, to be included as part of any standard ALGOL. . . .
 - 2. It is further recommended that WG E limit its language-measuring activity to the provision of test programs. . . .
 - D. The relationship between WG E and IFIP/WG 2.1 should be such that WG E as a standards processing authority will normally refer all technical or developmental problems and proposed solutions re ALGOL to IFIP/WG 2.1. . . .
. . . it is the hope of the USA that the general sense of the recommendations above will in any case be accepted and considered by the WG E group defining the language standardization procedure and program of work as essential elements thereof.”
- Working Group E accepted the IFIP ALGOL specification for consideration as a possible ISO Recommendation, and assigned it for study for the next meeting.

- [134] 62 J. H. Wegstein to X3.4 and IFIP WG 2.1:
Dec
28
- “On December 13, 1962, the BEMA Committee, X3.4 resolved that it is the USA position that ALGOL 60 (Rome) should not be considered as a standard without first dealing with input-output facilities and possibly even the settlement of the questions left by the Rome conference on ALGOL as well.

I believe that this does not represent the view of many people in the United States and other countries who are using ALGOL 60. . . .”

- [135] 63 U.S. position on IFIP ALGOL, Document ISO/TC97/
Jan SC5(USA-1)5:
7
This paper, emanating from ASA X3.4, informs ISO/TC97/SC5 that the U.S. is willing to consider as a standards proposal a version of ALGOL based on ALGOL 60 (Rome) with input-output facilities added, and/or the same for a subset of ALGOL 60 as developed by IFIP.
- [136] 63 N. Sanders and C. Fitzpatrick, in *Datamation*:
Jan “. . . The primary shortcoming of ALGOL as a computer language is its lack of a subroutine facility—a facility not required, of course, by a publication language. . . .
- The incorporation of the CALL statement changed the nature of a FORTRAN listing. No longer was it possible to read a FORTRAN program *per se* and understand it fully. The concept of remote compilation and, more seriously, remote *description* made it necessary for the reader of a FORTRAN program to have knowledge not contained in the listing itself. Consequently FORTRAN could have no claim to being a communication language and made no such claim. . . . As ALGOL is presently defined the language tail will wag the computing dog. Because of ALGOL’s desire to communicate man to man it does not have, rightly, any subroutine facility. Consequently the whole philosophy of computer operations would have to change. No longer the library tape! . . .
- It would be worthwhile to consider breeding a FORTRAN hybrid which would be capable of string manipulation and which would use a stack for at least parameter transmission to subroutines; thus making it ALGOL-like internally and allowing it to compile itself. . . .”
- [137] 63 SHARE XX Session on the 7090 ALGOL Compiler:
Feb
27 “About 150 people attended this session.” A 21-page report was distributed—“An Introduction to the SHARE ALGOL 60 Translator,” by R. G. Franciotti of IBM.
- [138] 63 F. Jones, in *Datamation*:
Mar “. . . ALGOL, on the other hand, faced the *de facto* standard, FORTRAN, and the pragmatics of the situation were and are such that popularity is not in the cards for ALGOL—no computer user who has a large library of FORTRAN programs, or who has access to the huge collective FORTRAN library, can justify the cost of conversion to a system which most are not even sure is superior. . . .”

[139] 63 Marjorie Lietzke (Manager, SHARE ALGOL Project) to
Apr the SHARE Membership:

1 “The SHARE Algol Project has reached a very important milestone. The first version of the SHARE Algol 60 Translator has been sent . . . for SDA distribution. . . .

We wish to emphasize that this is an experimental, not yet completely debugged, and in some respects not too efficient translator. However, it does implement most of ALGOL 60, and produces object code capable of giving correct answers on fairly complicated algorithms. . . .

For your convenience, as well as our own, we have integrated this first version of ALGOL with the FORTRAN II version 2 monitor so that the system tape is capable of running FORTRAN, FAP, and ALGOL. The libraries and operation are completely compatible. Later we plan to have ALGOL operating under IBSYS.”

[140] 63 Marjorie Lietzke (Manager, SHARE ALGOL Project) to
Apr Roy S. Dickson (Chairman, SHARE FORTRAN):

1 “I read, with considerable interest, your proposals for extensions to the FORTRAN IV language (SSD102, C-3179). A number of the items you mention have been implemented in the SHARE ALGOL 60 Translator. To mention a few:

1. Labels may be either numeric or alphabetic.
2. A statement label may be used as a parameter, thus permitting non-standard return from a subroutine.
3. The number of dimensions for a subscripted variable is not limited.
4. Array storage allocation may be completely dynamic, that is, all of it may be done at object time. There is no need for any dimensions to be fixed at compile time.
5. Subscript range checking is done at execution time, and subscripts may be positive or negative.
6. The loop control statement of Algol (*for* statement) may have positive or negative increments, either integer or floating point.”

[141] 63 Letter to the Editor of *Datamation*, from A. L. Cook:

Apr “. . . It is true that many of these compilers (European ALGOL) do not include a subroutine facility as defined by Messrs. Sanders and Fitzpatrick; this is, however, a limitation of the *compiler* rather than the ALGOL *language*. There is no difficulty in providing a library tape of pre-compiled ALGOL procedures. These need be subject to no restriction on generality and may make free use of global variables. The procedures would be automatically found and inserted into the correct block-level (not necessarily the outer block) of the object program as a single procedure call directed at the compiler.”

- [142] 63 J. W. Granholm, in *Datamation*:
 Apr “... Feb. 27th, in San Diego, Calif., the ALGOL Committee of the SHARE organization reported in open tutorial session. Gist of their report: ALGOL 60 is running on four 7090 installations—Rocketdyne ... General Atomic ... Oak Ridge National Laboratory ... and Marshall Space Flight Center. ... The master tapes ... are now available to any SHARE member. ...
 ALGOL, named by the Arabs, is a fixed star in the constellation Perseus. It was among the first of stars noted for its periodic variation in brightness, due to eclipse by its dark satellite. Its name, in Arabic, signifies ‘The Demon’. On last Ash Wednesday in San Diego, ALGOL might have proven not only to be a demon, but to be a genie rising with astounding magic from the bottle where it had been securely corked by its critics.”
- [143] 63 ASA Subcommittee X3.4, Programming Languages.
 Apr This reaffirmed the U.S. position of standardizing ALGOL on an
 25 international level rather than national, even should a national level need arise, which so far has not.
- [144] 63 Fourth Meeting of ISO/TC97/WG E, in Berlin, as reported
 Jun by H. Bromberg in 63 Aug issue of *Datamation*:
 5-7 “... The French ALGOL translation is currently in circulation in France for approval ... a straight translation which is to be used primarily for training purposes, and for promoting the implementation of ALGOL in French language countries. They recommend, however, that English words be used for programming purposes. The French standardization group has also prepared a draft proposal for standard hardware representation of ALGOL symbols. ...
 Germany reported presentation to the German standardization body of a first draft specification of an ALGOL 60 subset. This supersedes the ALCOR subset which had been previously considered. In addition, Germany is now considering a draft proposal to ISO/TC97/SC5 on representation of ALGOL symbols in five-channel tape and 80-column cards. Finally, they have prepared an English-German glossary of ALGOL Technical Terms for publication. ...
 The Italian National Activity Report stated that they are in the process of preparing a survey on programming languages and compilers. ... The Italian Standardization group is contributing to ALGOL ... through ECMA ... an Italian version of ALGOL 60 is being prepared.
 ... the Netherlands agree to all the points of the U.S. position on ALGOL except that they believe that changes should not be made to the revised ALGOL 60 language, but rather should be considered for the next ALGOL specification. ...
 Sweden reported that four ALGOL compilers ... are being constructed. Their standardization committee is also concerned with the problems of compatibility among the various ALGOL compilers.

The United Kingdom reported the establishment of a Programming Languages Technical Committee, DPE-13, under the British Standards Institution. . . . The United Kingdom section of the programming languages survey was updated and received by the U.S. Secretariat. . . .

The European Computer Manufacturers Association (ECMA) TC5 on ALGOL has been working on the preparation of an ALGOL subset which includes as many of the characteristics of the proposed IFIP subset as were known. . . .

. . . discussion of Subcommittee 5 resulted in unanimous approval of the following motion:

‘SC5 received with great interest the IFIP ALGOL 60 revised report and deems it a significant contribution to ISO/TC97/SC5 standardization work. However, the committee feels that this document in its present form is incomplete in that standard input-output procedures and specification of a proper subset should be included. Therefore, SC5 invites IFIP to submit at its earliest convenience a more complete document.’

. . . the following resolution was unanimously approved:

‘It is premature to decide today which choice we should make between ALGOL and FORTRAN due to the relative incompleteness of both documents presented to Subcommittee 5 and the fact that no criteria for evaluating a standard exist. It is therefore moved that the two candidate languages in the field of scientific programming be treated in parallel.’

The ALGOL Ad Hoc Working Group, under the chairmanship of William Heising of the USA reported consideration of the private Ingerman-Merner paper on ALGOL, which was presented as an example of current thinking in the United States. . . .

The Ad Hoc Working Group on FORTRAN, chaired by W. van der Poel of the Netherlands, presented the final report. . . .”

(It is of interest to note that Heising, who finally got together an IBM standard FORTRAN document to present to ASA, and van der Poel, who chairs the IFIP ALGOL Working Group, had ISO assignments which swapped the languages for which they were responsible. One can conclude correctly that this was deliberate and should pay off well.)

[145] 63
Jul
26

J. C. Boussard to the SHARE Secretary:

“I am pleased to let you know that the computation department in Grenoble has constructed a compiler for the Algol Language on IBM 7090-7044 computers.

The program, brought up for the first time at the Grenoble meeting (February 1963) translates Algol 60 instructions into FAP instructions directly performed by 7090/7094 and 7044 machines.

Since February 1963, this program was improved by being transferred upon an IBSYS-System-Tape, version 6, which allows us

from now to assemble and perform any number of ALGOL, FAP and FORTRAN programs, only parted at the input by "job" cards and a certain amount of control cards (see Fortran monitor).

During the following months, the same program will be added to the IJOB system, both upon 7090 and 7044 machines which will make it possible to use efficiently the IBBMAP assembler.

Our compiler is designed to accept any ALGOL program, with these few restrictions only:

- the input program must neither include a numerical label nor nested strings.
- all formal parameters must be specified and the type of every actual parameter must be identical to that of the formal corresponding parameter.
- all identifiers and labels written out in a switch declaration must be declared (defined for the labels) in the block where the declaration is located, or in a block outside.
- formal parameters specified as "label" cannot be called in by "value".

Other restrictions laid on input programs for the time being (recursive procedures, "arrays" called in by VALUE) are to be cancelled in the following next months.

A range of input-output procedures was defined for that compiler, they go from immediate input procedures to input-output procedures with specifications of FORTRAN formats. At last, all standard procedures advised by ALGOL committee on one hand, and all those which may be used in FORTRAN on the other hand, may be used in the input programs of the compiler.

The compiling method for this program: sequence of two passes of the input program (edition and generating), and wide-spread use of stacks make it possible to translate an ALGOL program into FAP instructions forming a program whose bulk and efficiency may be directly compared to those of FORTRAN II, version 3."

[146] 63 Working Conference on Mechanical Language Structures,
Aug in Princeton. Sponsored by the ACM, published in
14-16 *CACM*, 64 Feb.

[147] 63 Writing in *APIB* 18, E. W. Dijkstra reviews the GIER
Aug ALGOL manual.

Arguing against the need of subsetting ALGOL, he also notes that this is full ALGOL 60 except own arrays and arrays called by value, yet it was implemented for a machine with 1024 (40-bit) words of core store and 12800 of drum store, hardly extensive by today's measurements.

- [148] 63 A. S. Douglas, in *Datamation*, re the U.K. situation:
Aug “... Then, of course, one must these days have ALGOL (unless one is IBM). But ALGOL does not specify an input and output system much, and is not thought to be good for data processing. . . .”
- [149] 63 F. L. Alt succeeds R. F. Clippinger as Chairman of
Aug ASA X3.4.
- [150] 63 Third meeting of IFIP TC2, in Oslo.
Sep
9
- [151] 63 Second meeting of IFIP WG 2.1, in Delft. ECMA fur-
Sep nished a proposal for a subset of ALGOL.
10–13
- [152] 63 M. Lietzke to Manfred Paul, Mathematics Institute of
Sep Munich:
23 “Julien Green has informed me that your ALGOL Translator is now in the final check-out stage and that you are interested in having our SHARE ALGOL Project consider it as an alternative to the translator we have at present. Since our objective is to make the best possible Algol system available to SHARE members we would be most happy to consider your translator. . . .”
- [153] 63 M. Lietzke to Jean Claude Boussard, University of
Sep Grenoble:
30 “... I notice that you use French word delimiters; how difficult would it be to change the dictionary for your compiler to accept the standard English word delimiters? Do you have any provision for communicating with FAP or MAP assembled subroutines other than the built-in functions? . . .”
- [154] 63 J. C. Boussard to M. Lietzke:
Oct
29 “... All the Standard Functions specified in Paragraph 3.2.4. of the ALGOL 60 Report can be treated by the compiler. Input and output procedures are available and, in particular, FORTRAN-like Format Statements can be utilized by the programmer. The word delimiters or their abbreviations can be used arbitrarily in ENGLISH or in French. Notice that it is also valid to have a mixture of words in the two languages, as shown in the enclosed example. Some present restrictions of our compiler are as follows (1) ALGOL source programs should have less than 12,000 syntactical units, (2) the number of procedures is limited to 256, and, (3) the number of numerical constants should not exceed 2,000. As far as speed of compilation, we might add that it is comparable to that of FORTRAN II.

Among the restrictions to be observed in preparing source programs, the following are cited: (1) numerical labels are allowed, (2) own arrays with dynamic bounds are not permitted, and (3) all formal parameters must be specified and must be of the same type as actual corresponding parameters.

Turning to your last question, we do not have, at the present time, any means that permit the separate assembly of Algol and other languages. We are currently working on the problem of separate compilation with IBJOB and IBCMAP.”

[155] 63 A. P. Ershov to W. van der Poel, Chairman of IFIP
Nov WG 2, ALGOL:
4

“To my regret I shall not be able to attend at the second meeting of the WG 2. The main reason is that I have been received the official announcement too late (July 23, 1963) so I have no time to change my plans and to make necessary arrangements. . . .

3. Some news from the USSR:

- a. Two ALGOL translators for the M-20 computer are in an operation at present in the USSR. These are authorized by the Joint M-20 Users Commission attached to the Mathematical Institute, USSR AS. The first smaller translator for an ALGOL subset (no strings, no numerical labels, no recursive calls, no own, and some restrictions for procedure declarations and statements), consists of about 7000 instructions, multipass running, the speed of translation 1000-2000 operations per one source program symbol, a little optimization. The second translator which has been developed under guidance of Prof. Shura-Bura of Moscow University for full ALGOL minus dynamic arrays and numerical labels, consists of about 13,000 instructions, multipass running, the speed of translation 10-15 minutes per 1000 object instructions, some optimization. The ALPHA translator (Input Language without recursive calls and with some other minor restrictions) is now under experimental operation. It consists of 32,000 instructions, multipass running, the speed of translation about 5 minutes per 1000 instructions, careful optimization.
 - b. Bottenbruch's and Dijkstra's books on ALGOL 60 have been translated into Russian and are now in print. In addition, two or three original primers on ALGOL have been written and are in print too. An English translation of an extension of ALGOL 60 (Input Language) has been published in England and in the USA by the Academic Press.
 - c. There are 5 or 6 groups in the country wishing or beginning to develop translators for middle-size computers which are to be based on some ALGOL subsets. There are various opinions about the subsets but SMALGOL is in favor. . . .
8. I would like to make only one comment concerning possible discussion on ALGOL 60 at future meetings. I think it is necessary to separate problems of symbol manipulations from such points as complex arithmetics, matrix computations and so on.

I am sure that there should be an ALGOL-like, but separate language for string manipulations. I suppose September 1964 should be an appropriate date for the first discussion of the language.”

- [156] 64 Resolutions of the 33rd Meeting of ASA X3.4:
Feb
20
- “2. That a Working Group† be established . . . to undertake standardization responsibility for ALGOL in the United States. . . .
 3. That the United States position on ALGOL at the ISO meetings include the position that an input–output system based on that of the Knuth report‡ (ISO/TC97/SC5(USA–90)40) be supported and endorsed as a part of standard ALGOL. . . .
 4. At this time X3.4 wished to place on record its recognition of the excellent results produced by Don Knuth and the members of his ACM group. They have produced a good I/O set of facilities for ALGOL promptly at a critical time in the progress of standardization of ALGOL. . . .”

† X3.4.8, Chairman—J. Merner.

‡ In *CACM*, 64 May.

- [157] 64 Third meeting of IFIP WG 2.1., in Tutzing.
Mar
16–20
- The *ALGOL Bulletin* planned to be revived (No. 16 in May).

- [158] 64 R. F. Brockish to H. Bromberg, Chairman, Joint Users
Mar
17
- Group:
“At SHARE XXII in San Francisco, March 2–6, The SHARE Executive Board endorsed the following recommendation to ASA X3.4 from SHARE.

Recognizing (1) that ALGOL and FORTRAN are useful in closely related application areas and (2) that FORTRAN is still the more widely used of these two languages in the United States: X3.4 hereby instructs its delegation to the forthcoming ISO/TC97/SC5 meeting to support *no* action that would result in the consideration of an international standard ALGOL prior to equivalent consideration of an international standard FORTRAN.

Mr. Lynn Yarbrough of North American Aviation who is SHARE'S representative on X3.4 will present this recommendation to that group for acceptance.

SHARE's position in this matter is that FORTRAN is a widely used language that deserves equal attention when the question of an international standard computer language is considered by ISO. We feel that if ALGOL is considered without concern for FORTRAN and is declared a single standard, the chance of FORTRAN becoming a co-standard is remote. We feel that in the area of computer-independent languages for scientific applications, there is justification for both a standard ALGOL and a standard FORTRAN.”

- [159] 64 R. F. Brockish to M. Lietzke, in SSD 119:
 Mar 18 “I am writing on behalf of the SHARE Executive Board to convey to you our response to your recommendation that SHARE request IBM to assign one man to the maintenance of the ALGOL compiler. The SHARE Executive Board discussed your recommendation at length and does not consider that such a request would be in the best interest of SHARE. As you know by a vote of the general body at SHARE XVI in San Francisco, SHARE endorsed FORTRAN as the primary algebraic language and rescinded its request to IBM for an ALGOL compiler for SHARE machines. In keeping with the spirit of this resolution, although it in itself did not mention maintenance, the SHARE Executive Board feels that it should not request IBM to obligate itself to the maintenance of the SHARE developed ALGOL compiler.
 The Executive Board recognizes and thanks you for your enthusiastic efforts in developing the SHARE ALGOL compiler.”
- [160] 64 Resolution of X3.4, in Washington:
 Apr 21 “In view of the extensive development and preparatory work resultant from the initiative and request of TC97/SC5 and the USA as Secretariat, the USA urges SC5 to take action at its May 1964 meeting to enable a First Draft ISO Proposal Specification of ALGOL to be prepared for immediate circulation to SC5 under ISO Rules, and the USA will support such action.”
- [161] 64 Fourth meeting of IFIP TC 2, in Liblice, Czechoslovakia
 May 11 (near Prague):
 Proposals for IFIP SUBSET ALGOL 60 and input-output procedures were submitted by WG 2.1 and approved, both by TC 2 and the IFIP Council. This was in response to the ISO request. These proposals, labelled ‘final issue—22 Apr 64’, appear in ALGOL Bulletin 16, 64 May. It should be noted that the subset proposal derived mainly from the ECMALGOL, and ECMA standard (having previous input from ALCOR and SMALGOL).
 News item in 64 Jun issue of *Datamation*:
 “Moderation (and ALGOL) win out in Europe—A strongly worded attack on FORTRAN and IBM’s new programming language—made at a recent IFIP meeting in Prague—has been toned down, we hear, and now constitutes a suggestion for cooperation between ALGOL Working Groups and NPL development representatives. . . .”
- [162] 64 Announcement to SHARE ALGOL Mailing List:
 May 21 “The SHARE ALGOL 60 Translator, MOD4, has been sent to SDA this week. This version of the translator shows a considerable increase in speed over previous releases. . . .
 MOD4 will compile procedures separately, and will accept the standard ALCOR hardware representation with escape symbols, as well as our original reserved word hardware representation.”

- [163] 64 Fifth meeting of ISO/TC97/SC5, in New York:
May Major concentration led to the preparation of the *ISO Draft Proposal on the Algorithmic Language ALGOL*, prepared by an Ad Hoc Working Group on May 26–27. It included:
- (1) A full ALGOL based upon the IFIP specification.
 - (2) A unique subset based upon the IFIP specification.
 - (3) An elementary level of I/O procedures based upon the IFIP specification.
 - (4) A level of I/O procedures based upon the Knuth report.
 - (5) An appendix containing the transliteration table between the ALGOL symbols and the ISO 6- and 7-bit code proposals.
- This Proposal was accepted for processing as an ISO proposal. A paper was prepared on “Criteria for Standardization of a Programming Language” (published in the *Computer Bulletin*, 65 Mar).
- [164] 64 Noted in the *ALGOL Bulletin* No. 17, ALGOL compilers
Jul for Atlas and the CDC 3600, and a note from J. H. Wegstein:
- “There has been an overwhelming response to the algorithm reprint offer in the April 64 issue of the *ACM Communications*. . . . The speed with which requests have come in from several countries has been very encouraging as far as ALGOL interest is concerned. My supply of reprints was wiped out.”
- [165] 64 From the Minutes of SHARE XXIII:
Aug “Mr. L. Bolliet . . . described the ALGOL compiler which was
17–21 developed under his supervision at the University of Grenoble. This compiler was written in the intersection of the 7090/94 and 7040/44 instruction sets. On the 7090 it operates under IBSYS and uses the FORTRAN II Version 3 System to assemble and load the object code. On the 7040/44 the compiler operates under IBJOB and translates to MAP.
- The compiler has been submitted . . . for distribution.”
- “The ALGOL project presented a report for the compiler on 7040/44 and will continue to support the 7090/94 compiler under its new manager” (John Whitney).
- [166] 64 E. L. Manderfield to the Editor of the *ALGOL Bulletin*:
Aug “If you have any contact with any of the official European ALGOL-
30 ers who have some influence, I would like to suggest that they proceed with ALGOL 6X because among the ranks of the American SMALGOLers there has been a mass desertion to ‘NPL’. This is for two reasons, one is that ALGOL has never been a very popular language in America (partly because of the influence of the preponderance of IBMers, and partly because the ALGOL Maintenance Committee didn’t make very many friends the way they operated); and the other is that NPL has adopted apparently the best features of the current programming languages. . . .”

- [167] 64 News item in the *Computer Bulletin*:
 Sep “CPL is a programming language which has been developed jointly by members of the University Mathematical Laboratory, Cambridge, and the University of London Institute of Computer Science. . . . It is based on, and contains the concepts of ALGOL 60; in addition there are extended data descriptions. . . . However, CPL is not just another proposal for the extension of ALGOL 60, but has been designed from first principles, and has a logically coherent structure. . . .”
- [168] 64 One week course on Computational Linear Algebra and
 Sep Computer Programming in ALGOL, at the University of
 14-18 Manchester.
- [169] 64 Fourth meeting of IFIP WG 2.1, in Baden.
 Sep D. McIlroy, of the SHARE Advanced Language Development
 14-19 Committee, gave a presentation on NPL (New Programming Language). The meeting was devoted mainly to discussions of ALGOLs X and Y, X being a considerably extended and revised version, whereas Y is to be a completely new language with a rigorous definition in a metalanguage.
- [170] 64 Working Conference on Formal Language Description
 Sep Languages, under auspices of IFIP TC 2, Dr. H. Zemanek,
 15-18 Conference Chairman. Proceedings published by North-Holland, 1966.
- [171] 64 P. Naur, in the *ALGOL Bulletin* No. 18:
 Oct “In designing ALGOL 60 the assumption was implicitly made that a program written in a language common to many machines cannot take advantage of special features of any of them. . . . A better way of description is that ALGOL 60 prescribes one particular abstract machine. Particular implementations must then simulate this machine as best they can. . . . In passing it may be noted that the same kinds of difficulties are present in COBOL. In COBOL all data are basically expressed in terms of character strings. Simulating COBOL in a machine equipped with fast binary arithmetic is therefore excessively wasteful. . . .”
 (A proposal follows for a version of ALGOL with environment and data divisions.)
- [172] 64 News item in *Datamation*:
 Oct “. . . IBM is committing itself to the New Programming Language. Dr. Brooks said that COBOL and FORTRAN compilers for the System/360 were being provided ‘principally for use with existing programs’. . . . Further, announced plans are for only two versions of COBOL . . . and two of FORTRAN . . . but four of NPL. . . .”

- [173] 64 Meeting of the ALCOR Group, in Bad Soden/Taunus, to
Oct consider the effects of ALGOL X on processor construc-
19-20 tion. Attendance by about 80 persons.
- [174] 64 Publication, in *Datamation*, by C. J. Shaw of an algorithm
Dec (in something like ALGOL) for singing the old Christmas
favorite, "A Partridge in a Pear Tree (APIAPT)". Good
fun.
- [175] 65 SHARE XXIV Session Report, by J. R. Whitney, Chair-
Mar man:
3 "The last rites of SHARE ALGOL were held in the Garden Room
East. In attendance were approximately 15-20 mourners, most of
them there out of curiosity, I suppose. Not a single tear was shed
when it was announced that SHARE ALGOL had become part of
history."
- [176] 65 Note in the *Computer Bulletin*:
Mar "Great interest has been shown in the proposed card-index scheme
for algorithms. No details of this scheme have yet been finalized, but
the editor would be glad to hear from any concern or individual
interested, particularly if they have suggestions as to how it might
best be implemented. . . ."
- [177] 65 IFIP 65 Congress, New York City.
May
24-29
- [178] 65 B. A. Galler to the Editor of *Datamation*:
May "Your editorial of March, 1965, strongly suggests that the manu-
facturers be handed the language development business 'without the
confusing influence of users who want every software system to
include their pet esoteric options which tend to reduce compiler
speed and efficiency.' I must remind you of some historical facts:
(1) If a group consisting largely of users hadn't come up with ALGOL
in the face of a practically standard FORTRAN, there would be
very little that is new in NPL.
(2) Some of us users were involved in showing the manufacturers
that it is possible to have both a decent language (not pet options)
and compiler speed.
(3) If users hadn't objected *violently* to early versions of NPL, you
would have found procedure-oriented languages set back some
years. (You have only to compare the final version of NPL with
versions 1 and 2 to see what I mean.) . . .
I note that ASA is now following the progress of NPL. How in the
world could anyone seriously consider NPL as a standard now when
not a single program has gone through a computer? . . . NPL

wasn't even announced until it had gone through six versions. It must surely be expected to go through another six before it settles down. . . .

What harm is there in watching it as a potential standard, I will be asked? Has anyone ever tried to make changes in something which is 'almost a standard'? And there will be those who are pleased if no changes can be made. But let us be forever grateful that FORTRAN I is not a standard now."

- [179] 65 A. d'Agapeyeff, in *Datamation*:
 May "The absence in Europe of a large vested interest in FORTRAN has led to a ready acceptance of the advantages of ALGOL as a language. It is the main vehicle for university teaching and is in widespread use particularly in Holland, Germany and Scandinavia. In Germany ALGOL or ALGOL-like compilers have been available for some six years, allowing an extensive body of experience to be built up.
 In Britain the progress of ALGOL has been more hesitant. . . . Furthermore, with one striking exception, it is only recently that really useful ALGOL compilers have been released. However, it is now the policy of two of the three main British manufacturers to support ALGOL, and it is backed by the majority of the universities. It would seem, therefore that, subject to the future impact of NPL, Britain will go along with the rest of Europe in favouring ALGOL."
- [180] 65 Fifth meeting of IFIP WG 2.1, in Princeton.
 May
 17-21
- [181] 65 Fifth meeting of IFIP TC 2, in New York.
 May
- [182] 65 News item in *Datamation*, "U.S.S.R.'s Evshov Speaks in
 Jul L.A.":
 "Primary programming effort in recent years has been in the development of ALPHA, an extended-ALGOL compiler (45K instructions, 20 passes), five years in the making. Designed for use on the M-20 (a 4K core machine which averages some 20,000 instructions/second), the compiler produces object programs at the rate of 150 three-address instructions/minute. 'It was very difficult,' Evshov said, but ALPHA has been in operation one year, and some 2000 programs have been translated, and the compiler has increased program production by two or three times. . . .
 Of other computer work in the Soviet Union, Evshov noted the announcement of plans for ALGEC, a language which will combine ALGOL and an economic (or business) language. . . ."

- [183] 65 ACM Programming Languages and Pragmatics Conference, in San Dimas.
Aug 8–12 Proceedings in *CACM*, 66 Mar.
- [184] 65 Sixth meeting of ISO/TC97/SC5, in Copenhagen.
Sep 6–10
- [185] 65 SHARE-JUG Conference on Programming Language Objectives of the Late 1960's, in Philadelphia, as reported in *Datamation*:
Oct 7–9
- “IBM, said William McClelland, does not see ‘any need for any other major new procedure-oriented language development which is not a direct and essentially compatible extension of the existing languages.’ . . . The ideal, he proffered, one IBM is working on, would be that ‘manufacturers provide not compilers for languages themselves as a principal product, but a metalanguage compiler and expressions of standard forms of the appropriate language in that metalanguage. Users would then be able to tailor the language to their individual needs. . . .
- What about existing languages? Standards on two, FORTRAN and ALGOL, are (at time of writing) being voted upon at the ISO meeting in Japan. Will manufacturers support these standards? Attitudes, although positive, varied slightly. IBM gave an unequivocal *yes* for FORTRAN and COBOL, while UNIVAC noted that it would be ‘guided by the needs’ of its users. . . .
- A GSA spokesman on PL/I was quoted by a panelist as saying the ‘government would have to protect its investment in COBOL and FORTRAN.’” (Elsewhere it was referenced that the 1964 inventory of government EDP equipment lists 5885 applications, 19% using FORTRAN as primary language, 3%—COBOL, and 1.8%—ALGOL.)
- [186] 65 ISO/TC97 Plenary meeting in Tokyo.
Oct
- The delegates of all national members approved the draft proposals, with the exception of the Netherlands, and the USSR, which abstained. The form was then changed to an ISO Recommendation, which will be prepared by an Editing Committee for circulation to ISO members for final approval. At the same time the levels of the language were increased from two to four—ALGOL 60, ECM-ALGOL plus recursion, ECMALGOL and the IFIP SUBSET. The transliteration tables will not be included, since no agreement could be found.
- [187] 65 News item in *ALGOL Bulletin* No. 21:
Nov
- “Telefunken have incorporated the I/O procedures proposed by the ACM Committee . . . into the ALGOL-System for the TR4 computer. . . . User’s comments are very favourable. . . .”

- [188] 65 Sixth meeting of IFIP WG 2.1, in St. Pierre de Chartreuse.
 Oct The main topic of work continued to be ALGOL X.
 25-29
- [189] 65 Sixth meeting of IFIP TC 2, in Nice.
 Nov
 2
- [190] 66 46th meeting of X3.4, Common Programming Languages,
 Mar in New York.
 11 Add up the plane fare and expenses for standardization work!
- [191] 66 Seventh meeting of IFIP TC 2, in London.
 Apr It was reported that the ISO Recommendation (ISO/TC97/SC5
 26 (Secretariat-26)102) had been edited and sent to AFNOR for
 translation into French. FORTRAN has already been through this
 process, but final action is delayed until completion of translation.
- [192] 66 Publication of "System 360 Operating System—ALGOL
 May Language"—IBM Form C28-6615-0.
- [193] 66 News brief in *Datamation*:
 Aug "IBM, whose giant software efforts for the 360 line are swallowing
 an estimated \$60 million in 1966, has taken on the development of
 another language compiler-ALGOL. Particularly aiming to meet
 the needs of the large ALGOL user group in Europe, the firm will
 deliver an F level, or 44K, compiler during third quarter 1967. It
 will meet the standard adopted by the European Computer Manu-
 facturers Assn. and the International Federation of Information
 Processing. Said C. B. Rogers, director of systems marketing, 'We
 believe System/360's PL/I and FORTRAN offer greater flexibility
 than ALGOL to scientific users, and we are encouraging conversion
 wherever it is practical'."
- [194] 66 Training Course run by C.E.I.R., Arlington, Va., on
 Aug "ALGOL for FORTRAN Programmers".
 15-17

Algol References

COMMUNICATIONS OF THE ACM (Association for Computing Machinery)

Year	Vol.	No.	Page	
1958	1	8	3	Yershov, A. P., On Programming of Arithmetic Operations.
1958	1	8	12	Strong, J. <i>et al.</i> , The Problem of Programming Communication with Changing Machines, Part 1.

Year	Vol.	No.	Page	Paper
1958	1	9	9	Strong, J. <i>et al.</i> , The Problem of Programming Communication with Changing Machines, Part 2.
1958	1	10	5	Conway, M. E., Proposal for an UNCOL.
1958	1	12	8	Perlis, A. J. and Samelson, K., Preliminary Report, International Algebraic Language.
1959	2	2	6	Green, J., Possible Modifications to the International Algebraic Language.
1959	2	3	6	Wegstein, J., From Formulas to Computer-oriented Language.
1959	2	6	21	Williams, Jr., F. A., Handling Identifiers as Internal Symbols in Language Processors.
1959	2	9	19	Bemer, R. W., A Proposal for a Generalized Card Code for 256 Characters.
1959	2	9	24	ALGOL Subcommittee Report—Extensions.
1959	2	9	25	Green, J., Remarks on ALGOL and Symbol Manipulation.
1959	2	10	19	Kanner, H., An Algebraic Translator.
1959	2	10	25	Recommendations of the SHARE ALGOL Committee.
1959	2	12	14	Irons, E. T. and Acton, F. S., A Proposed Interpretation in ALGOL.
1960	3	2	76	Samelson, K. and Bauer, F. L., Sequential Formula Translation.
1960	3	3	170	Floyd, R. W., An Algorithm defining ALGOL Assignment Statements.
1960	3	4	211	Smith, J. W., Syntactic and Semantic Augments to ALGOL.
1960	3	4	213	Green, J., Symbol Manipulation in XTRAN.
1960	3	5	299	Naur, P. (Ed.), Report on the Algorithmic Language ALGOL 60.
1960	3	7	418	McIsaac, P., Combining ALGOL Statement Analysis with Validity Checking.
1960	3	8	463	Huskey, H. D., Halstead, M. H., McArthur, R., NELIAC, a Dialect of ALGOL.
1961	4	1	3	Huskey, H. D. and Wattenburg, W. H., A Basic Compiler for Arithmetic Expressions.
1961	4	1	10	Grau, A. A., Recursive Processes and ALGOL Translation.
1961	4	1	15	Bottenbruch, H., Use of Magnetic Tape for Data Storage in the ORACLE-ALGOL Translator.
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1963	6	3	77	Naur, P., Documentation Problems, ALGOL 60.
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1963	6	9	502	USA National Activity Report to ISO/TC97, Subcommittee 5, Computers and Information Processing, 15 May 1963.
1963	6	9	544	An Open Letter to X3.4.2.
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1965	8	8	496	Gries, D., Paul, M., Wiehle, H. R., Some Techniques Used in the ALCOR ILLINOIS 7090.
1965	8	11	671	Naur, P., The Performance of a System for Automatic Segmentation of Programs within an ALGOL Compiler (GIER ALGOL).
1965	8	12	786	Anderson, J. P., Program Structures for Parallel Processing.
1965	8	12	791	Index by Subject to Algorithms, 1965.
1966	9	1	13	Wirth, N. and Weber, H., EULER: A Generalization of ALGOL, and its Formal Definition, Part I.
1966	9	2	72	Parnas, D. L., A Language for Describing the Functions of Synchronous Systems.
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1961	Oct	41	—, ALGOL: a critical profile (RAND Symposium, Part 2).

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1963	Jan	30	Sanders, N. and Fitzpatrick, C., ALGOL and FORTRAN Revisited.
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1963	Apr	26	Clippinger, R. F., Progress in Language Standards.
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18	64 Oct	26	Naur, P., Proposals for a New Language.
22	66 Feb	28	Woodger, M., ALGOL X, Note on the Proposed Successor to ALGOL 60.

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ELEKTRONISCHE RECHENANLAGEN

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1963	5	2	77	ALGOL Dictionary.
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1966	8	2	49	Muller-Merbach, H., Die Lösung des Transportproblems auf Rechenautomaten—ein ALGOL-Programm.
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1967	9	3	101	Schrader, K.-H., Eine Sprache und ein ALGOL-Programmsystem für Probleme der Mechanik der Systeme (MESY).

COMPUTER APPLICATIONS SYMPOSIUM (Armour Research Foundation, Chicago, now Illinois Institute of Technology Research Inst.)

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1961	115	Naur, P., The Progress of ALGOL in Europe.
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		217	Revised Report on the Algorithmic Language ALGOL 60.

1959 PROCEEDINGS, INTERNATIONAL CONFERENCE ON INFORMATION PROCESSING (Paris, 1959 June 15–20, UNESCO, Verlag Oldenbourg, Munich, 1960)

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132	Poyen, J. and Vauquois, B., Suggestions for a Universal Language (in French).
152	Symposium on Automatic Programming: (3) Huskey, H. D., A Variation of ALGOL. (5) Bauer, F. L. and Samelson, K., The Cellar Principle for Formula Translation.

1963 PROCEEDINGS, INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING (Munich, 1962 Aug 27–Sep 1, North Holland Publishing Co., Amsterdam)

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487	Samelson, K., Programming Languages and their Processing.
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503	Denison, S. J. M., A Proposed ALGOL 60 Matrix Scheme.
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513	Symposium of Languages for Processor Construction.
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535	Dijkstra, E. W., Some Meditations on Advanced Programming.
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1965 PROCEEDINGS OF IFIP CONGRESS 65
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1966 PROCEEDINGS OF THE IFIP WORKING CONFERENCE ON FORMAL LANGUAGE DESCRIPTION LANGUAGES (T. B. Steel, Jr. (Ed.), North Holland Publishing Co., Amsterdam, 1966)

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139	Garwick, J. V., The Definition of Programming Languages by their Compilers.
148	Nivat, M. and Nolin, N., Contribution to the Definition of ALGOL Semantics.
221	Ingerman, P. Z., The Parameterization of the Translation Process.
249	Gorn, S., Language Naming Languages in Prefix Form.
266	Landin, P. J., A Formal Description of ALGOL 60.
295	Duncan, F. G., Our Ultimate Metalanguage.

1962 SYMBOLIC LANGUAGES IN DATA PROCESSING
(Gordon and Breach, New York, London, 849 pp.)

Page	Paper
23	Ingerman, P. Z., A Translation Technique for Languages Whose Syntax is Expressible in Backus Normal Form.
65	Paul, M., A General Processor for Certain Formal Languages.
75	Culik, K., Formal Structure of ALGOL and Simplification of its Description.
207	Samelson, K. and Bauer, F. L., The ALCOR Project.
219	Huskey, H. D., Machine Independence in Compiling.
229	van der Poel, W. L., The Construction of an ALGOL Translator for a Small Computer.
237	Dijkstra, E. W., An Attempt to Unify the Constituent Concepts of Serial Program Execution.
253	Kiyono, T. and Nagao, M., Comments on the ALGOL System for the Small and Medium Size Computers.
263	Palermo, G. and Pacelli, M., Sequential Translation of a Problem-Oriented Programming Language.
317	Picciafuoco, U. and Pacelli, M., Non-Dynamic Aspects of Recursive Programming.
325	Wohlfahrt, K., On Static and Dynamic Treatment of Types in ALGOL Translators.
331	Hill, U., Langmaack, H., Schwarz, H. R., Seegmuller, G., Efficient Handling of Subscripted Variables in ALGOL 60 Compilers.
341	Dolotta, T. A., A Method of Editing a Program in Symbolic Language.
385	Naur, P., The Basic Philosophy Concepts, and Features of ALGOL.
391	Woodger, M., The Description of Computing Processes. Some Observations on Automatic Programming and ALGOL 60.
409	van Wijngaarden, A., Generalized ALGOL.
421	Moriguti, S., A Family of Symbolic Input Languages and an ALGOL Compiler.
439	Pacelli, M., Gavioli, D., Palermo, G., Picciafuoco, U., PALGO, an Algorithmic Language and its Translator for Olivetti ELEA 6001.
449	Savastano, G. and Fadini, B., The Algebraic Compilers for Bendix G-20 Computing System.
473	Bosset, L., MAGE, A Language Derived from ALGOL Adapted to Small Machines.
481	Schwartz, J. I., JOVIAL, A General Algorithmic Language.
495	Katz, C., GECOM, the General Compiler.
501	Balke, K. G. and Carter, G. L., The COLASL Automatic Coding Language.
539	Mazurkiewicz, A., Compiler-Interpreter for Using in Numerical Oriented Languages Translation.

ALGOL (OR CLOSELY RELATED VARIANTS) BOOKS

- 1962 Dijkstra, E. W., *A Primer of ALGOL 60 Programming*, Academic Press, London, 114 pp.
- 1962 McCracken, D. D., *A Guide to ALGOL Programming*, Wiley, New York, 106 pp.
- 1962 Halstead, M. H., *Machine Independent Computer Programming*, Spartan Books, Washington, D.C., 267 pp. (NELIAC).
- 1962 Galler, B. A., *The Language of Computers*, McGraw-Hill, 244 pp. (MAD).
- 1963 Wooldridge, R. and Ratcliffe, J. F., *An Introduction to ALGOL Programming*, The English Universities Press, London, 131 pp.
- 1963 Evshov, A. P., Kozhukhin, G. I., Voloshin, U. M., *Input Language for Automatic Programming Systems*, Academic Press, London, 70 pp.
- 1963 Güntsch, F. R., *Einführung in die Programmierung Digitaler Rechenautomaten*, Verlag Walther de Gruyter, Berlin, 388 pp.
- 1964 Bolliet, L., Gastinel, N., Laurent, P. J., *Un Nouveau Language Scientifique: ALGOL: Manuel Pratique*, Hermann, Paris, 196 pp.
- 1964 Randell, B. and Russell, L. J., *ALGOL 60 Implementation, The Translation and Use of ALGOL 60 Programs on a Computer*, Academic Press, 418 pp.
- 1964 Baumann, R., Feliciano, M., Bauer, F. L. and Samelson, K., *Introduction to ALGOL*, Prentice-Hall International, London, 142 pp.
- 1964 Reeves, C. M. and Wells, M., *A Course on Programming in ALGOL 60*, Chapman and Hall, London, 82 pp.
- 1964 Anderson, C., *An Introduction to ALGOL 60*, Addison-Wesley, 57 pp.
- 1964 Math. Laboratory, Royal Radar Establishment, *Programming in ALGOL 60*, 29 pp.
- 1964 Nickel, K., *ALGOL-Praktikum: Eine Einführung in das Programmieren*, Karlsruhe, Braun, 220 pp.
- 1965 Nicol, K., *Elementary Programming and ALGOL*, McGraw-Hill, 147 pp.
- 1965 Bauer, F. L., Heinhold, J., Samelson, K., Sauer, R., *Moderne Rechenanlagen: Eine Einführung*, Stuttgart, Teubner, 357 pp.
- 1965 Hawgood, J., *Numerical Methods in ALGOL*, McGraw-Hill, 178 pp.
- 1965 Arsac, J., Lentin, A., Nivat, M., Nolin, L., *ALGOL: Theorie et Pratique*, Gauthier-Villars, Paris, 204 pp.
- 1965 Broise, P., *Le Langage ALGOL; Applications à des Problèmes de Recherche Opérationnelle*, Dunod, Paris, 99 pp.
- 1965 Ekman, T. and Fröberg, C.-E., *Introduction to ALGOL Programming*, Lund, 1965 and Oxford University Press, 123 pp.
- 1966 Schaeffler, G. F., *A Course in ALGOL Programming*, MacMillan, London 192 pp.
- 1966 Kerner, I. and Zielke, *Einführung in . . . ALGOL*, Teubner, Leipzig, 283 pp.
- 1966 Marcovitz, A. B. and Schweppe, E. J., *An Introduction to Algorithmic Methods Using the MAD Language*, MacMillan, New York, 433 pp.
- 1966 Ingerman, P. Z., *A Syntax-oriented Translator*, Academic Press, New York, 131 pp.
- 1966 Herschel, R., *Anleitung zum praktischen Gebrauch von ALGOL*, R. Oldenbourg Verlag, München, 162 pp.
- 1967 Lecht, C. P., *The Programmer's ALGOL*, McGraw-Hill, New York, 251 pp.
- 1967 Higman, B., *A Comparative Study of Programming Languages*, Macdonald, London, 164 pp.

VARIOUS OTHER PAPERS ON ALGOL

- Bottenbruch, H., Übersetzung von algorithmischen Formelsprachen in die Programmiersprachen von Rechenmaschinen, *Zeitschrift math. Logik Grundlagen* 4, 1958, 180–221.
- Heise, W., ALGOL—et Internationalt Sprog for Elektron Regnemaskiner, *Ingeniøren*, 68, årg, 17, 505 (1959).
- Bottenbruch, H., Erläuterung der algorithmischen Sprache ALGOL anhand einiger elementarer Programmierbeispiele, *Bl. Dtsch. Ges. Versicherungsmath.* 4, 1959, 199–208.
- Stephan, D., Die Algorithmische Sprache ALGOL 60, an Beispielen erläutert, *Bl. Dtsch. Ges. Versicherungsmath.* 5, 1960, 61–86.
- Bottenbruch, H., *A Critical Study of ALGOL*, Univ. Illinois, Digital Computer Laboratory Report 105, 60 Dec 8.
- Bauer, F. L., The Formula-controlled Logical Computer “Stanislaus”, *Mathematics of Computation (MTAC)*, 14, 1960, 64–67.
- Dijkstra, E. W., Recursive Programming, *Numerische Mathematik* 2, 60 Oct, 312–318.
- Gibb, A., *ALGOL 60 Procedures for Range Arithmetic*, Stanford Univ., Applied Math. and Stat. Laboratories, Tech. Report 10, 61 Apr 12.
- Kudielka, V. et al., *Extension of the Algorithmic Language ALGOL*, 1961 July, Mailüfterl, Vienna, 34 pp. (U.S. Govt. Report DA-91-591-EUC 1430).
- Lucas, P., *Die Strukturanalyse von Formelübersetzern*, 1961, Mailüfterl, Vienna.
- Evshov, A. P., The Basic Principles of the Development of the Programming Program of the Institute of Mathematics of the U.S.S.R. A. S., *Siberian Mathematical Magazine* 2, No. 6, 1961.
- Bauer, F. L. and Samelson, K., Maschinelle Verarbeitung von Programmiersprachen (Processing of Programming Languages by Computer), in *Digitale Informationswandler*, Vieweg & Sohn, Braunschweig, 1962, 227–268.
- Nederkoorn, J., *A PERT Program in ALGOL 60*, Technical Report 56, Mathematical Centre, Amsterdam, 63 Feb, 22 pp.
- The Descriptor*, Burroughs B5000, Form 20002P.
- Extended ALGOL Reference Manual for the Burroughs B5000*, No. 5000-21012, Burroughs Corp., Detroit, 1963.
- SHARE ALGOL 60 Translator Manual*, No. 1426, 1577, SHARE Distribution Agency, IBM.
- ALGOL 60, An Introduction for FORTRAN Programmers*, Elliott Bros., London, 1963.
- Boothroyd, *A Guide to Machine-Independent Compiler Programming and ALGOL*, English Electric LEO, Kids Grove, 1963.
- van der Mey, G., *Process for an ALGOL Translator*, Dr. Neher Laboratory, Leidschendam, Netherlands, Report 164 MA.
- Naur, P., (Ed.), *A Manual of GIER ALGOL*, Regnecentralen, Copenhagen, 1963.
- Ageev, M. I., *The Principles of the Algorithmic Language ALGOL 60*, Computing Centre AN U.S.S.R., Moscow, 1964, 116 pp. (revised edition, July 1965).
- Koster, C. H. A., *Efficient Rekenen in ALGOL*, Report of the Mathematical Centre, Amsterdam.
- Randell, B., Whetstone ALGOL Revisited, or Confession of a Compiler Writer, *Automatic Programming Information Bulletin* 21, 64 Jun, 1–10.
- Popov, V. N., Stepanov, A. G., Stisheva, A. G., Travnikova, N. A., A Programming Program, *Journal of Computational Math. and Mathematical Physics*, 4, 1, 1964.

- Shura-Bura, M. R. and Lubimskiy, E. Z., Translator: ALGOL 60, *Journal of Computational Math. and Mathematical Physics* 4, 1, 1964.
- Petrone, L., *Operators and Procedures in ALGOL-type Languages*, EURATOM, Ispra, Italy, EUR 2417.E, 65 May, 9 pp.
- Evshov, A. P. (Ed.), *ALPHA Automatic Programming System*, USSR Academy of Sciences, Siberian Division, Novosibirsk, 1965, 264 pp.
- Cohen, J. and Nguyen-Huu-Dung, Definition de Procedures LISP en ALGOL; Exemple d'Utilisation, *Revue Française de traitement de l'Information* 8, 4, 1965, 271–293.
- Perlis, A. J., Formula Manipulation in Extended ALGOL, *Mededelingen v.h. Nederlands Rekenmachine Genootschap* 7, 6, 65 Dec.
- Thiessen, E., Automatic Conversion of BELL-programs to ALGOL-programs, in *Computing* 1, 4 (1966), 354–357.
- Iturriaga, R., Standish, T. A., Krutar, R. A., Earley, J. C., Formal Compiler Writing System FSL to Implement a Formula ALGOL Compiler, *Proceedings AFIP Spring Joint Computer Conference*, 1966, 241–252.
- Wirth, N., An Introduction to FORTRAN and ALGOL Programming, in *Mathematical Methods for Digital Computers*, Vol. 2, John Wiley & Sons, New York, 1967, 5–33.
- Bolliet, L., Auroux, A., Bellino, J., DIAMAG: A Multi-access System for Online ALGOL Programming, *Proceedings AFIP Spring Joint Computer Conference*, 1967, 547–552.
- Leroy, H., A Macro-generator for ALGOL, *Proceedings AFIP Spring Joint Computer Conference*, 1967, 663–669.

SUMMARY OF PUBLICATION OF FORMAL SPECIFICATIONS FOR THE ALGOL LANGUAGE

- Preliminary Report—International Algebraic Language:
in Communications ACM 1, 58 Dec, 8 (Note 1);
Annual Review in Automatic Programming 1, 1960, 268–289 (Note 1).
- Report on the Algorithmic Language ALGOL:
in Numerische Mathematik Bd. 1, 1959, 41–60 (Note 2).
- Report on the Algorithmic Language ALGOL 60:
in Communications ACM 3, 60 May, 299–314 (Note 3);
Numerische Mathematik 2, 1960, 106–136;
Annual Review in Automatic Programming 2, 1961, 351–390;
Acta Polytechnica Scand., Math, and Computing Machinery Series 5, AP 284;
Chiffres 3, 1960, 1–44 (French);
 Regnecentralen, Copenhagen, 1960, 40 pp.
- Revised Report on the Algorithmic Language ALGOL 60:
in Communications ACM 6, 63 Jan, 1–17;
The Computer Journal 5, 63 Apr, 349–367;
Annual Review in Automatic Programming 4, 1964, 217–258;
Numerische Mathematik 4, 1963, 420–453.

- Notes: (1) Equivalent to the CACM publication, not identical to the original ditto copy entitled “Zurich Conference on Algorithmic Language, Preliminary Report”, 37 pp., due to further editing by Bemer.
- (2) Equivalent to the ditto report.
- (3) Reprints made available with typographical corrections as of 60 Jun 28 and 62 Apr 1.

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1	59 Mar 16	— 6	14	62 Jan 16	18
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5	59 Sep 28	8	18	64 Oct	53
6	59 Oct 17	1	19	65 Jan	63
7	59 Nov 3	21	20	65 May	50
8	59 Dec 12	11	21	65 Nov	83
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11	60 Dec 23	10	24	66 Sep	37
12	61 Apr 24	17	25†	67 Mar	30
13	61 Aug 18	13			

(Note: Starting with *ALGOL Bulletin* 16, produced under the sponsorship of IFIP WG 2.1, ALGOL, F. G. Duncan, Editor. Issues prior to this were produced by the Regnecentralen, Copenhagen, P. Naur, Editor.)

SUMMARY OF ALGOL BULLETIN SUPPLEMENTS

(Those published in regular journals and books will be indicated only by that reference)

Number	Mailed	Paper
1	59 Jun	Woodger, M., A Description of Basic ALGOL.
2	60 Mar 2	(The ALGOL 60 Report.)
3	60 Oct 20	Kerner, I., Bericht uber die algorithmische Sprache ALGOL 60.
4	60 Nov 30	(The Computer Journal 3, No. 2, 67.)
5	60 Nov 15	Jensen, J., Jensen, T., Mondrup, P., Naur, P., A Manual of the DASK ALGOL Language, Regnecentralen, Copenhagen.
6	61 Mar 17	(CACM 4, No. 1, 55.)
7	61 Mar 17	(CACM 4, No. 1, 59.)
8	61 Feb 3	(Computer Applications Symposium, 1960, 154.)
9	61 Apr 24	Naur, P., A Course of ALGOL 60 Programming, Regnecentralen, 38 pp.
10	61 Nov	Dijkstra, E. W., ALGOL 60 Translation.
11	61 Apr 24	(BIT 1, No. 1, 38.)
12	61 Jun 29	(The Computer Journal 4, No. 4, 292.)
13	61 Jun 26	(CACM 4, No. 1, 60, 65.)
14	61 Aug 29	(Input Language, see Book List.)
15	61 Aug 24	(BIT 1, No. 2, 89.)
16	61 Nov 6	Lucas, P., The Structure of Formula-Translators.
17	61 Oct 10	Youden, W. W., An Analysis of ALGOL 60 Syntax.
18	61 Oct 26	(Computer Applications Symposium, 1961, 115.)

† Also in SICPLAN Notices 2, No. 5, May 1967.

SUMMARY OF AUTOMATIC PROGRAMMING INFORMATION BULLETINS
(Automatic Programming Information Centre, Brighton, England)

Issue	Issue date	Pages	
1	60 Mar	2	
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5	60 Nov	11	
6	61 Feb	17	
7	61 May	36	(Special ALGOL 60 issue)
8	61 Jun	23	
9	61 Aug	12	
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12	62 Jan	25	
13	62 Mar	15	
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(Discontinued 66 Feb, having achieved its aims. Richard Goodman, the Editor, died in August 1966 after a long illness.)

IFIP TECHNICAL COMMITTEE 2—PROGRAMMING LANGUAGES
(Chairman—H. Zemanek)

Meeting	Date	Locale
1	62 Mar 20	Munich
1	62 Mar 27	Rome
2	62 Aug 25	Munich
3	63 Sep 9	Oslo
4	64 May 11	Liblice
5	65 May 20	New York City
6	65 Nov 2	Nice
7	66 Apr 26	London
8	67 May 20	(Amsterdam)

IFIP WORKING GROUP 2.1—ALGOL
 (Chairman—W. van der Poel)

Meeting	Date	Locale
1	62 Aug 28–30	Munich
2	63 Sep 10–13	Delft
3	64 Mar 16–20	Tutzing
4	64 Sep 14, 19	Baden
5	65 May 17–21	Princeton
6	65 Oct 25–29	St. Pierre de Chartreuse
7	66 Oct 3–8	Warsaw
8	67 May 16–20	Zandvoort

ISO/TC97/SUBCOMMITTEE 5—PROGRAMMING LANGUAGES
 (Chairman—R. W. Bemer)

Meeting	Date	Locale	
1	61 May 18	Geneva	(as Working Group E)
2	62 May 9–10	Stockholm	„
3	62 Oct 9–13	Paris	„
4	63 Jun 5–7	Berlin	„
5	64 May 25–28	New York	(as Subcommittee 5)
6	65 Sep 6–10	Copenhagen	
7	67 Nov 6–10	Paris	