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C L A M : A COMPUTER LANGUAGE MODEL

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This paper describes a program which translates English into French. It is difficult to delineate the subset which a program can deal with, so sample sentences are given.

The analyser is multiple path, single pass, akin to Woods' A.T.N. grammar. The syntax is dealt with by matching with templates; the semantics by the application of semantic restrictions to syntactically associated pairs of word meanings. To limit the number of paths, all available guns, syntactic and semantic, are brought to bear at every stage. The output is a list of disambiguated word meanings, formed into a tree structure but with semantic rather than syntactic relationships between them.

The French generation first makes appropriate tense changes, then finds the French word(s) and redistributes them if necessary. This may generate a French structure radically different from the English. Then the words are sequenced and put into the correct form.

The program consists of about 8,500 Fortran instructions and the processing averages about 15 seconds per word on a 360-40.

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INTRODUCTION

There are, I hope three reasons why CLAM will be of interest to computational linguists.

(1) It is a working model. This is not a "paper" containing "ideas". It is a description of a model which works. To be more specific, it is a description of a large program, written in FORTRAN, which runs on a 360-40. It accepts as input English text, carries out a syntactic and semantic analysis of it, stores the result, and translates it into good French.

(2) The subset of English which it is capable of analysing is, by present standards, extremely large. The vocabulary is about 1300 words, many of which have a variety of meanings. More important that the size of the vocabulary is, of course, the range of syntactic structures and, perhaps most significantly, the degree of complexity of sentences which can be dealt with. Increasing the length and complexity of sentences does not bring likelihood of combinatorial explosion. The amount of working store and computing time required to analyse a sentence is of the order of the number of words in a sentence, although of course it varies according to the number of meanings of the words and the types of syntactic structure involved.

(3) The program is continuously extensible. This extensibility applies first to the subset of language which can be analysed, secondly to the target languages into which translations can be generated, and thirdly to the uses to which the analysis of the text can be put. In other words, I believe that

the program embodies a sound method of syntactic and semantic analysis such as must be the basis of a computer language model.

Extension of the subset of language which can be analysed is a matter of addition and refinement. It can be stated with confidence that such extension can be achieved because nothing fundamentally different from what has already been achieved is involved. New syntactic structures, well formed or otherwise, can be incorporated, by addition partly to the files and partly to the program. Continual refinements can be made to the method of finding pronoun antecedents. This problem, which seems to be generally accepted as the most difficult single problem in analysis, will never be solved by one simple algorithm, and the fact that a particular program at any given stage of its development gives the wrong answer in a particular case, so far from invalidating the program, rather points the way to further refinements (cf. Wilks, June 1975). What is important is that the program should provide the tools which enable the refinement to be made, and CLAM does this.

Extension of the target languages involves applying to other languages the same method which is used to generate French. This can be done, and indeed part of the actual program used for French would be generally applicable. It will be interesting to attack a language outside the Indo-European group, and Arabic is the first one I have in mind, although how soon this can be done is a question of time and priorities.

The obvious use to which the analysis can be put other than

translation is a question-answer system, and work on this is at present in hand. A question-answer system must be based on an effective analyser, and it is believed that CLAM can provide this. However, I do not maintain that the analyser should be independent of the memory and inferencing part of the system. Obviously it should not be independent of the memory, since an analyser must create and use its own memory, and although it would be theoretically possible for the analyser to have one type of memory and the latter part of the program to have another, this would be a ludicrous arrangement. The same argument applies to inferencing, which again has to be performed by an analyser. Therefore it seems that a question-answer system should be more integrated than many A.I. researchers appear to allow. On this score, I support the view of Wilks vis-a-vis Charniak.

To create a question-answer system, and, indeed, to improve the translation program, the memory and the semantics of the present program have to be developed. I use the word "developed" advisedly because I believe that the existing memory and semantics form a sound basis upon which a more comprehensive system can be built.

RESULTS

Assessment of the Subset of Language which the Model can Analyse

It is normal practice when describing a language model to leave discussion of the achievements of the model until the end.

First comes the description of how the model does or would operate, then, if it is actually in operation, an account of what it can do. In this description I am reversing the procedure, because I would not like to think of a reader ploughing through details of how something is done if he subsequently comes to the conclusion that what was done was not worth doing anyway. Let him first see what can be done, and then decide whether it is worth the trouble of reading on to discover how it is done.

Having said this, I am immediately confronted by the problem adumbrated by Woods of how a reader can assess the range and scope of a particular model, and by implication, of how the programmer can honestly present it. There are two standard methods of presentation. One is by rather sweeping general statements such as "the program can cope with noun clauses, adjectival clauses, conjunction, questions" etc., according to what claims are being made. Such generalisations are inevitably suspect and rightly so, since no reader will believe that he could not find, for example, adjectival clauses which the program could not cope with. The alternative method of presentation is to give sample sentences which the program has coped with, and hope that the reader will make for himself the type of generalisation which the programmer has scrupulously avoided. If the first method is adopted, the programmer may justifiably be branded as a charlatan. If the second, he runs the risk of having his sentences dismissed as "a few examples".

The problem is real, and the solution far from obvious: how to define a subset of language. Supposing that we were concerned only with single sentences and not longer texts; and supposing that it were possible, which evidently it is not, to list all the sentences of the subset: then how can we find a definition which would include all the sentences which we have listed and exclude any which we have not listed? Two things are clear. The definition would be very long, and it would contain an agglomeration of embedded provisos. For example, the section on relative clauses might include something like this:

Relative clauses are admissible, provided that

1. they do not contain more than seven words;
2. they do not contain a passive verb
   unless (a) it is a verb of 'cooking'
   or (b) the clause is a 'subject' clause;
3. there is no word between the noun and the relative clause unless it is part of a supervening relative clause;
4. the noun is not part of a subsidiary clause unless the subsidiary clause is itself a relative clause
   provided that (a) the noun is not the object of the clause
   and (b) the noun is not a 'time' noun.

All of the above provisos are of a type which could well be applicable at any particular stage in the development of a program, although some may be more likely than others. The programmer's difficulty is that until he has tried an appropriate type of sentence, he probably will not realise the existence of a

particular limitation. The first indication of it is that the sentence doesn't work, and he then has to rack his brain to find out why not, and alter the program to eliminate the limitation, thereby enlarging the subset in that particular direction (hoping that he is not at the same time being so stupid as to reduce it in another). Therefore if a programmer asserts that his program can deal with e.g. relative clauses of all types, he is probably not being dishonest but merely ignorant about the limitations of his own program. Whether such limitations should rightly be described as bugs, which Woods implies, is dubious, because that is tantamount to execting a program which can deal with some relative clauses to be able to deal with all relative clauses, and asserting that insofar as it cannot, something has gone wrong. Rather might one think of a program in terms of a pool of water spreading slowly over an area and gradually covering more and more of that area. The fact that the water covered a particular part of the area would carry no implication of covering any other part, although there would be a reasonable expectation of its spreading to a contiguous area next. This analogy, though valuable in helping to destroy a misconception, is evidently incomplete in two respects. It is two-dimensional, whereas language is multi-dimensional; and the program would advance not continuously, like a pool of water, but by fits and starts, in discrete steps. Each of these points is worth further examination.

Lip service has long been paid to the multi-dimensional nature of language, and yet the importance of this aspect in

attempting to analyse language has rather slowly come to be recognised. How many features are there which have to be taken into account, and what are they? How many possible relationships can exist between which of them? And, a question raised with particular force by computer analysers, what combinations of features are relevant? As a simple example, consider two features, both as it happens syntactic although the argument applies to semantic as well as syntactic features: relative clauses, and the passive voice. If a program can analyse each of the features separately, does it follow that it can analyse them in combination? Suppose, for example, it can analyse both of these sentences:

1. The man who came to dinner stole the silver.
2. The man was hit by a bus.

Does it follow that it can analyse this?

The man who was hit by a bus stole the silver.

Alas, it does not. It may in fact be able to, but there is no logical rule from which it can be deduced that it must be able to. Is the absence of suc a rule merely a computational quirk, or does it correspond to some linguistic truth? In this case, but not necessarily in all such cases, I would say that it does so correspond. We may ask ourselves if it is possible to imagine a language in which relative clauses exist, and the passive voice exists, but in which the verb in a relative clause cannot be in the passive. Of course it is, and there may for all I know be such languages. It is this absence of a logical rule of combination which makes the task of defining the bounds of a

subset of language so appallingly difficult, especially when it is remembered that it is not merely combinations of two features, as in the above example, but combinations of many features which have to be taken into account. Multi-dimensionality is such a cardinal characteristic of language that analysers dealing with tiny subsets from which this characteristic has been removed should probably be treated with reserve. They may give valuable insights, but they may also be misleading. I do not of course refer to the memory or inferencing part of microworld models, which is usually their raison d'etre, but only to their interface with natural language input. The designers of such models are inclined to regard the input analysis as little more than a tedious chore, and would be unlikely to take exception to what I am saying since they themselves normally make no great claims for this part of their models. But others, commenting on the models, sometimes make exaggerated claims on behalf of the analysers, and these claims should be guarded against. Perhaps the relationship between a language and a tiny subset of it with a strictly limited number of features should be thought of as akin to the relationship between a wall and a stone. They are recognisably composed of the same substance, but one has essential characteristics which the other totally lacks.

Before leaving the subject of multi-dimensionality, I would like to touch briefly on the possibility, at some time in the future, of devising a standard method of determining the extent of a subset of a language. The following idea could be considered, probably to be rejected, but at least it could provide a starting-

point for discussion. A number of features, say n, could be decided upon, the number varying according to the degree of subtlety of delineation required. An n-dimensional array with n+1 columns in each dimension (for the n features + 1 blank) would then contain an element corresponding to every combination of these features. Some of these elements would be irrelevant, since they would represent impossible combinations. The valid elements could be filled or not, according to whether the subset contained the combination of features which they represented. For a programmer building up the subset which his program was capable of analysing, such an array could provide both a measure of achievement and a guide to what was missing.

To return now to the analogy of the puddle, the second respect in which it was incomplete was that a program, as it develops, does not advance continuously, like water spreading, but by fits and starts, in discrete steps. Suppose, for example, that a programmer is testing a particular feature like, say, relative clauses, as that is the feature we have previously discussed. Sentences containing relative clauses have been entered repeatedly, and each time they have been rejected or analysed incorrectly. Then at last comes the moment of triumph and relief when, for the first time, the program takes in such a sentence and analyses it correctly. At that moment, the program has not merely edged forward, but it has leapt. In terms of the array postulated in the last paragraph, not just one but several elements will in all probability have been covered in one step. It will not be known for certain which elements, until

more testing has been done and more sentences tried. But just as it would be ludicrous to suppose that because a program can analyse one relative clause it can analyse all, it would be equally ludicrous not to expect a program which can analyse one relative clause to be able to analyse at least some others. There is a section of program common to all relative clauses, which has to work before any can be analysed correctly, and once that section is working in combination with any features, the liklihood is that it will work in combination with at least some others.

What follows from this? Firstly, that no reliable method at present exists for the designer of a language model to delineate the subset of language which his model can analyse. Secondly, that desirable as it undoubtedly is, for the benefit of both the designers of models and those who seek to assess their scope, to devise such a method, it is going to be extremely difficult to do so. Thirdly, that in this unfortunate state of affairs a designer can but fall back on the established system of presenting a list of sentences which his program has analysed correctly, and leave it to the reader to make his own assessment of where the bounds of the subset analysable by the model lie. To discuss the sentences as simply a few examples would be unintelligent; equally unintelligent to see in them visions of universality. Where, between these two extremes, the reader's judgement falls should depend upon the variety of the sentences, and upon their complexity. If the program can deal with complexity in any area, it should be some indication of its power,

perhaps yet unrealised, to do so in other areas. It would be a sign of its versatility, of its ability to disentangle elaborate patterns and resolve them into their elementary components.

After this rather prolix introduction, I come eventually to my own "list of sentences" that have been successfully analysed by CLAM. They fall into two categories: those which have been translated into French, in which case the French translation is given; and those which have simply been analysed syntactically, and semantically and reduced to a base form. This is because during the last year I have not been working on the French generator but concentrating on certain aspects of the analyser; and so in order to save computer time, the French generation has been omitted. Thus the sentences without translation have been processed last.

The question arises of what exactly is meant by "analysed syntactically and semantically" and "reduced to base form". This will be more fully explained in the subsequent text. At this stage it is sufficient to say that a syntactic tree has been formed and semantic ambiguities resolved, and that semantic relations between words in the tree have been determined (e.g. a syntactic subject of a passive verb is recorded as the semantic object). Single word meanings are retained as basic units. There is no Schankian-type resolution into semantic primitives, except insofar as this is implicit in the classification system. This is the base form from which the French has been generated. It has not so far proved necessary to go any baser. Development, as will be explained later, is envisaged along the lines of extending

the network rather than breaking down the units.

SAMPLE SENTENCES

The following are samples of sentences which have been correctly analysed by the program. They are given, together with the French translations where these have been produced by the program, and with comments on points of interest in the sentences.

1. The shirt which you sold is dirty.

   La chemise que vous avez vendue est sale.

   Relative clause.

2. The man and woman doctors saw have eaten the bread.

   L'homme et la femme que les medecins ont vu ont mange le pain.

   Contact clause (relative clause with relative pronoun missing).

   Simple conjunctive phrase.

   No article in English but article required in French.

3. I want the king to read the book.

   Je veux que le roi lise le livre.

   Accusative and infinitive.

4. I thought she would eat.

   J'ai pense qu'elle mangerait.

   Object clause with "that" missing.

5. He hurt some donkeys last month.

   Il a fait mal a des anes le mois dernier.

   Multiple-word verb in French.

6. He went to see the house.

Il est alle voir la maison.

He lived to eat.

Il a vecu pour manger.

Different types of infinitives.

7. The watch will work when the mechanic finishes working.

La montre fonctionner quand le mecanicien finira de travailler.

Time clause: present tense in English becomes future in French.

"De" after "finir" followed by infinitive instead of gerund.

Different meanings of "work".

8. When did you open the door?

Quand es -ce que vous avez ouvert la porte?

Question.

9. Drink the milk faster.

Buvez plus rapidement le lait.

Command.

10. The men got up.

Les hommes se sont leves.

Two-word verb.

Reflexive.

Verb takes "etre".

11. The clever queen's uncle disagreed.

L'oncle de la reine intelligente n'a pas ete d'accord.

Possessive.

Position of adjective.

12. Peel the potatoes for your mother.

Epluchez les pommes de terre pour votre mere.

Multiple-word noun.

13. Teachers write plays in March in some countries.

Les instituteurs ecrivent des pieces en Mars dans des campagnes.

Semantic resolution of "in".

'Des campagnes' should be 'certains pays

14. He stood up to put the fire off.

Il s'est leve pour eteindre le chauffage.

Two-word verbs.

15. That waiter, fat and stupid, was breaking the plates.

Ce serveur gros et stupide cassait les assiettes.

Appositional adjectives between commas.

Continuous tense.

16. The man who drank the wine does not laugh.

L'homme qui a bu le vin ne rit pas.

Negative.

17. You frightened the man whose pen you stole.

Vous avez effraye l'homme dont vous avez vole la plume.

"Whose"-- difficult construction.

18. The woman who you swam with is happy.

La femme avec qui vois avez nage est contente.

Floating preposition at end of relative clause.

*

19. The woman looks depressed and bored.

La femme a l'air ennuye and deprime.

Semantic resolution of "looks"

'Ennuye' and 'deprime' should be feminine. My ignorance.

20. The Queens should have arrived.

Les reines auraient du arriver.

"Should have" -- difficult construction.

21 I had to learn to shout.

J'ai du apprendre a crier.

Semantic resolution of "had".

22. Your brother, you and I found and your father bought her horses.

Votre frere, vous et moi avons trouve et votre pere a achete ses chevaux.

Mixed conjunction.

23. If you had come you would have met him.

Vous l'auriez recontre si vous etiez venus.

Conditional clause.

Compound tenses.

Pronoun object.

Concord of past participle after "etre".

24. Picking flowers is wrong.

Cueillir des fleurs est mauvais.

Gerund subject.

25. The king is as large as a cow.

Le roi est aussi grand qu'une vache.

"As" comparative.

26. I have never behaved rudely since you allowed me to stay.

27. He prefers painting pictures to working.

28. As many as six aeroplanes took off.

29. Men bought the book and clock. They mended it. It often did work.

Pronoun resolution.

30. How good a game is tennis.

31. I know which house the man was living in.

32. I know how easily embarrassed you are.

33. How clean a brush did you sweep the room with.

34. Men can understand which book is best.

DESCRIPTION OF METHOD

Before going into some detail about the method used to achieve these results, I would like to say something about the danger of over-sophistication on the part of the reader. There is a natural tendency for researchers, on reading something new, to look for points of broad similarity with something, anything, that they have read before; and, having found it, to sit back with relief and feel absolved from reading any further. In a field in which vast amounts are being written, it is a proper self-defence on the part of the reader, but in A.1. in particular, it has its special dangers.

When one passes from the realm of pure ideas to the hard practicalities of writing a computer program, a subtle change of emphasis occurs. The ideas, all embracing they may have

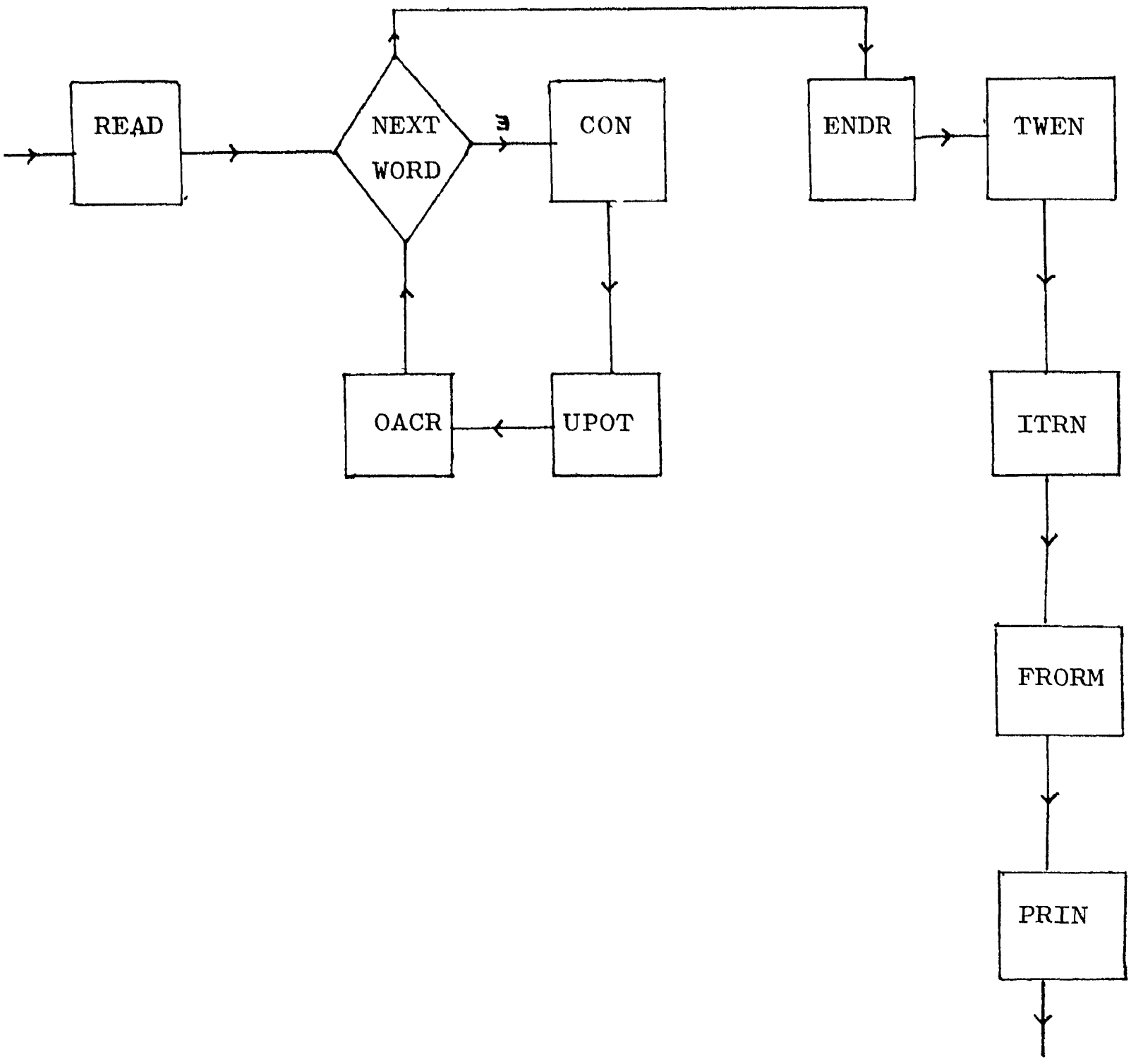
seemed at their inception, recede into the background, and what become vital are the details, the tiny mosaic pieces which determine whether the program succeeds. To judge a computer program by a crude classification of its method is like judging a picture by saying that it is impressionistic. Certainly it is impressionistic, but is it any good?

In case the reader is not convinced by this argument, let me say immediately that this is a multiple-path, single-pass, left-to-right, word-by-word analyser, akin to the multiple-path analyser of Oettinger and the augmented transition networ grammar of Woods. In order to tackle the semantics, and indeed also the syntactics, the meanings of words have been coded according to a hierarchical taxonomy That they are coded has been largely dictated by the demands of FORTRAN, in which the program is written, although some system more overtly like a networ could have been used. That the classification should be essentially hierarchical, with certain necessary refinements, has always seemed obvious.

Some details of how the program works now follow. I will start with the syntactic and semantic analysis, and come later to the generation of the French.

FLOWCHART

find codes | syntactic and semantic analysis | French



REDUCTION OF THE PASSAGE TO BASE FORM

A glance at the flowchart on the preceding page shows that there are two main parts of the program: first, the single subroutine READ, and second, a group of subroutines comprising the syntactic and semantic analysis.

READ This subroutine first transfers the base form of the preceding sentence to semi-permanent store. Then it reads the next sentence. It looks up each word in the dictionary file (VOCAB). If it cannot find it at first, it tests for certain endings such as -s, -ed, and -ing, subtracts them and tries again. When it finds the word it stores all the possible codes which are associated with the word in VOCAB. It also assembles compounds such as 'in front of', 'in order to', or infinitives, for which there is no single code. Proverbs or cliches can be similarly treated.

Coding Every possible meaning of a word has a code number containing a maximum of twelve digits. These code numbers are stored with the word in VOCAB and extracted in READ. The coding is based on a straightforward classification. For example the code of 'bull' is $\underset{\text{animal}}{6}\ \underset{\text{farm}}{2}\ \underset{\text{cow}}{1}\ \underset{\text{noun}}{2}\ \underset{\text{concrete}}{1}\ \underset{\text{creature}}{1}\ \underset{\text{male}}{1}$ Such classification is essential to reduce the number of syntactic and semantic patterns which have to be stored. It may be noted in passing that the system of coding contains the elements of both syntactic and semantic classification. The distinction between the two is at times tenuous. Further explanation of the coding is given in the appendix.

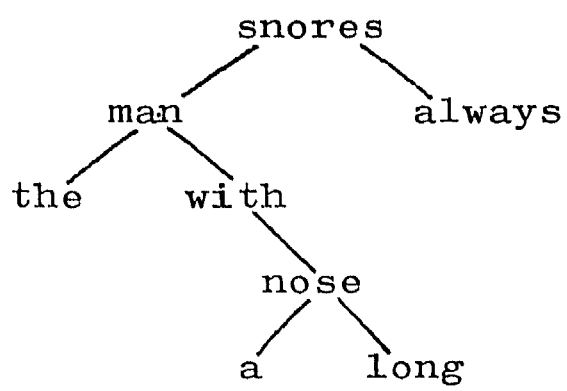
Syntactic and Semantic Analysis This is the most complicated part of the model, and comprises several sub-routines. For ease of explanation, many of them are here treated as parts of the larger routines CON, UPDT and OACR. As the flowchart shows, these three routines operate in turn on each word of a sentence, and when the end of the sentence is reached, a fourth routine, ENDR, is called on to operate on the complete sentence .

Before giving some account of the functions of these routines, it is necessary to explain the term EP, and to describe JEP and JSP, the two principle files referred to in this part of the program.

EP (English pattern). Take the sentence, The man with a long nose always snores. The program breaks this down into four EPs, as follows:

	EP 1	EP 2	EP 3	EP 4
lead word	snores	man	with	nose
subsidiary word	man	the	nose	a
subsidiary word	always	with		long

An EP contains one lead word plus a number of subsidiaries, and is classified according to the nature of the lead word. Thus EP 1 is a verb EP, EPs 2 and 4 are noun EPs, and EP 3 is a preposition EP. Man, the lead word of EP2, is a subsidiary of EP 1, so EP 2 is dependent on EP 1. Similarly, EP 3 is dependent on EP 2, and EP 4 on EP 3. Splitting a sentence into EPs is simply forming it into a tree structure.



JEP This file contains the templates for all the different types of EP. For example the template for a noun EP contains various types of adjective in appropriate sequence. These are followed by the lead noun. This is then followed by adjectives, appositional nouns, prepositions and relative pronouns. In an EP certain positions, such as the lead, are necessary, while others are optional. In a noun EP, the only necessary position is the lead noun. In a preposition EP, besides the lead preposition, the following noun is necessary. By far the most complicated EP is of course the verb EP. In this EP, later positions can be either closed, or opened, or made necessary, by a particular class of word in a particular position. For example, a pre-verb subject closes a post-verb subject. A question verb makes a post-verb subject necessary. One class of verbs opens a subsequent gerund position and closes a subsequent infinitive. Once an EP has been started, the program tests to see if the next word could occupy an open position on the template as far as the next necessary position (cf. below). Note that these templates are of syntactic patterns and bear no relation to Wilks' semantic templates.

JSP This file contains all the semantic patterns (SPs). An example of an SP is 12119 21 21102. This means that all verbs whose codes start with the digits 12119 can have as subjects any nouns whose codes start with the digits 21102. More specifically, it means that human beings read or write. In this case the verb would be the lead of a verb EP, and the noun would be a subsidiary word in the subject position of the EP. The middle group of digits in the SP specify the relationship between subsidiary and the lead. In this case, 21 specifies subject of verb. Similarly, SPs govern the relationships between the lead verb and all other subsidiary positions in the verb EP, and between lead and subsidiaries of all the other EPs. For example, 621 2 226 means that time prepositions, whose code words start with the digits 621, can have as objects any time nouns whose codes start with digits 226. When deciding whether a word is acceptable in a subsidiary position of a particular EP, a semantic match is made between that word and the lead word: JSP is searched to see if an SP exists permitting that word to be associated in that subsidiary position with that lead word (cf. below).

Processing the Sentence The sentence is processed in a single pass word by word from left to right. After each word, a number of possible continuation paths are open. The next word is tested along each of these paths, and if no place can be found for it that path is closed. If no places can be found, the path is reproduced n-1 times and the word added to each path Each path may then have one or more continuations.

Let us now return to the sentence, The man with a long nose always snores. The program goes through the sentence word by word, starting from the first. At the beginning, a verb EP is "open". That is to say, the program looks for all positions which could start a verb EP which the first word satisfies. In this case, 'the' cannot be part of a verb EP, but only of a noun EP, so the program will start a noun EP which is dependent on the subject position of a verb EP. The next word must continue the noun EP. Therefore on going to the next word, only EP2 is "open". 'Man' is then read, and EP2 and also EP1 are updated. At this point there are two alternative continuations. Either EP2 could be continued, as in fact happens, or EP2 could be "closed" and EP1 continued. Therefore on going to the next word, EPs 1 and 2 are both open. So the process is continued through the sentence.

As shown in the flowchart, there are three subroutines which operate on each word--CON, UPDT and OACR.

CON takes each EP which is open, and tests each sense of the word against each possible continuation of the EP. If the word could satisfy a position, it then looks to see whether a form match is necessary. In general, in English, a form test is only necessary between subject and verb, when the number and person must agree. If this hurdle is overcome, CON then proceeds to a semantic match. In general, the lead word of an EP must be matched semantically with every subsidiary word of that EP. For example a subject must be matched with a verb. So a check is performed, to see if that particular noun taken in that

particular sense could be the subject of that particular verb taken in that particular sense. Having found all the possible solutions, CON then gives way to UPDT.

UPDT updates each EP according to the solutions found in CON. It reproduces EPs as necessary where more than one solution has been found, and discards EPs which have become defunct because no solution has been found. It also determines which later positions of an EP either can or must be filled as a result of the current word becoming a part of the EP. It then hands over to OACR.

OACR (Open and Close Routine) determines which EPs must be kept "open" for the next word. It also performs some juggling with EPs in certain rather tricky cases such as relative clauses. It then returns control to the root program for the next word.

When all the words of the sentence have been processed, ENDR is entered. This examines all existing solutions. It discards any that are incomplete, and performs some housekeeping on those which are complete in order to separate them. In future, it will make a choice between alternative solutions, although this part of the program has not yet been written.

After ENDR, the sentence has been reduced to one (or more) sets of connected EPs. Within an EP, for each subsidiary word the relationship to the lead word (eg. verb/object, verb/time-noun, noun/article, etc.) is specified, as are the code(s) remaining as a result of the semantic matches which that word has undergone during the analysis.

After this brief description of the functions of the various subroutines, a more detailed explanation of the semantic match follows. We then show how the program deals with some of the more complex problems which it encounters.

Semantic Matching In order to illustrate the method, a simplified example is given, using the word 'in'. Take the sentence, She walked in fields in May. Suppose after READ, the following codes are in store:

```
 1..312.....1
 2..1141.....2
 3..1141.....2
 4..521.....3
 5..621.....3
 6..6216.....3
 7..6212.....3
 8..631.....3
 9..6311.....3
10..21274....4

11..521.....5   adverb
12..621.....5   place preposition object - place
13..6211.....5  place preposition object - city
14..6212.....5  place preposition object - country
15..631.....5   time preposition object - time period
16..6311.....5  time preposition object - month
17..22355....6
```

The last digits, 1 to 6, refer to the word number. 'In' is words 3 and 5 with code numbers 4-9, 11-16. Suppose the codes have the same meanings as shown ascribed to 11-16. Suppose further that "places" start with digits 2127, and that 'field' is 21274, also that "time periods" start with digits 223, and that "months" start with 2235.

It may well be asked why the distinction has been made between the three place prepositions and between the two time prepositions. There could be two reasons: either that the

concept of the preposition changes (which is probably not true here), or that the tranalation is different in some target language. If it is only the second case, the distinction could have been left for the program which generates the target language to draw. However, it is more economical to deal with it during the semantic matching.

Now let us see how the disambiguation process works. This example is simplified because it does not show the semantic matching across prepositions, between 'walked' and 'fields', and between 'walked' and 'May'. Although sometimes necessary for complete disambiguation, it is not so in this example, and as it complicates the explanation, I will omit it here for the sake of simplicity.

After the second word, there is only one EP open.

			code range	
EP1	lead	walk	2-2	(The meaning of "code range" will appear presently.)
	subject	she	1-1	

The third word, 'in', has two syntactic classes, adverb or preposition. Both are acceptable at this point in the verb EP. So a semantic match is performed between each class of 'in' and the lead word 'walk'.

Suppose that one SP gives 114 5 52,

another gives 11 6 62,

and another gives 11 6 63.

All the codes of 'in' are accepted-- code 4 by the first SP, codes 5, 6 and 7 by the second SP, and codes 8 and 9 by the third

The EP has to be reproduced because there are two syntactic classes of 'in'. We therefore have the following:

			code range				code ranges	
EP1	lead	walk	2-2	EP2	lead	walk	2-2	2-2
	subject	she	1-1		subject	she	1-1	1-1
	adverb	in	4-4		preposition	in	5-7	8-9

in EP2 there are two code ranges, one for the place preposition and one for the time prepositions. EP3, a preposition EP attached to EP2, is now opened, and for the next word this preposition EP and EP1 are open, but EP2 is closed.

The next word, 'fields', is a place noun. It is not accepted in EP1, which is therefore discarded. It is accepted in EP3 as the object of the preposition, so a semantic match is performed between 'in' and 'fields'.

Suppose there is an SP, 62 2 2127. Codes 5-7 are then accepted by this SP, and EP3 then looks like this:

			code range
EP3	lead	in	5-7
	object	field	10-10

A reconciliation is now carried out between the codes of 'in' in EP3 and EP2. As a result, the second code range in EP2 is eliminated.

The next word, 'in' again, is now read, and the process is repeated. EP2 now looks like this:

EP2	lead	walk	2-2	2-2
	subject	she	1-1	1-1
	preposition	in	5-7	5-7
	preposition	in	12-14	15-16

This time, on 'May', the relevant SP is 6311 2 2235.

There would also be an SP like this: 63 2 223.

But the first SP gives a narrower code range (16-16 instead of 15-16), and so it is preferred. This time, on reconciliation, the first code range in EP2 is eliminated and the second is reduced. So at the end, the three EPs are thus:

EP2	lead	walk	2-2	EP3	lead	in	5-7	EP4 lead in 16-16
	subject	she	1-1		object	fields	10-10	object May 17-17
	preposition	in	5-7					
	preposition	in	16-16					

We are now left with a code range for the first 'in' containing three codes. In such cases, it is the first code of the range which is selected. So 'in' has been disambiguated to 621 in the first case, and to 6311 in the second.

Syntactic Complexities Of course, it is all very well for a program to be able to digest, She walked in fields in May. But can it also cope with this?

The farmers we were talking about grew, and the green-grocers, thieves and liars, sold those apples.

In other words, the program must be capable of being expanded to deal with the myriad complexities and exceptions of natural

language. However sound the principles underlying a program may be, such expansion involves a deal of intricate and detailed work. At every stage,, flexibility and rigidity have to be balanced. The program must be flexible enough to envisage possibilities, but rigid enough to exclude impossibilities and to latch onto the right solution when it appears. The programmer's task resembles a tailor's. Let out an inch or two more, take in a couple there. It would be satisfactory indeed if an algorithm could be found both concise and comprehensive which would encompass all the requirements, but language is such a barnacled growth that this seems on the face of it improbable. It would be surprising if excrescences in the program were not necessary to deal with excrescences in the language. In the development of this program, when the treatment of a new structure has been added, whenever possible the original framework has been adapted to incorporate it, thereby avoiding the necessity of adding large sections of program. This is only commonsensical. Nevertheless, the program has grown considerably with its capacity to handle larger areas of language.

Here is perhaps a suitable point to emphasise that, since this is a multiple-path analyser, at each point all the available information, syntactic and semantic, has been deployed to eliminate incorrect paths. This has been done not only to avoid unnecessary computation, but also because the storage limits have made it essential. There are only 25 EPs. Frequently during testing this store overflowed, but interestingly enough

it has always been possible to bring the demand on it back within bounds by finding some restriction which had been overlooked and which cut out one of the paths. It had originally been feared that 25 EPs would not be nearly enough. One of the satisfying discoveries of the program is that it is.

Of course the deployment of all available information is not the only approach. Most of the earlier program concentrated on the syntax and paid little heed to the semantics. Wilks, on the other hand, is relying primarily on the semantics and is taking from the syntax only what is absolutely necessary. It will be fascinating if his research is able to determine exactly how much of the syntax is unnecessary. There are obvious redundancies in the form of unnecessary safe-guards in language. No one who has struggled with German case endings is ignorant of this. In English, we have the concord between subject and verb in the third person of the present, patently unnecessary since it exists only in this one instance. There are many sentences in which the semantics alone are clearly sufficient. In the sentence, "The man ate the steak with a fork.", the words could appear in any sequence and the meaning would be decipherable, although it might take longer to decipher. The interesting question is what features of the syntax can be consistently ignored, without occasional sentences cropping up which can only be deciphered with the help of these features.

There now follows a description of the treatment of three notoriously awkward problems-- relative clauses, pronouns, and conjunction.

Relative Clauses Six cases are distinguished:

1. The man who met you.
2. The man who(m) you met.
3. The man who(m) you gave it to.
4. The man to whom you gave it.
5. The man you met.
6. The man you gave it to.

After the lead of a noun EP, a relative pronoun (94), a preposition (6), and a contact noun (2R) are all possible continuations.

'Who' has three relative pronoun codes, starting with,

941, subject of relative clause,

942, object of relative clause,

943, object of preposition in relative clause.

'Whom' obviously only has the last two.

EP1 man	EP2 man	EP3 man	EP4 ---
the	the	the	(man) (subject)
who 941	who 942	who 943	
EP5 ---	EP6---	EP7 ---	
(man) (object)	---	(man) (preposition object)	

When a relative pronoun is recognised, the noun EP, EP1, is reproduced to EPs 2 and 3, and the codes 941, 942, and 943 are added to separate noun EPs. Then in OACR, new EPs 4 to 6 are opened dependent upon the noun EPs. In the case of 941 and 942, the lead of the noun EP, 'man', is entered in the new EPs as subject and object respectively. They are marked so as to avoid translation, but they are necessary for semantic matching in the relative clause. In the case of 943, an additional new

preposition EP, EP7, is opened dependent upon the relative clause EP, and the lead of the noun EP, 'man', is entered as the object of this preposition EP. The relative clause EP is marked as waiting for a floating preposition, although when a preposition comes this EP is reproduced, and in one EP the preposition is taken as the floating preposition, while in the other EP it is taken as another preposition. This is necessary to allow for such clauses as, the man whom you gave the book in the end to.

In the cases of 941, 942 and 943, the only EP which is open for the next word is the relative clause EP. For 941 the next necessary word in the EP is the lead verb, while for 942 and 943 the next necessary word is the subject. In practice, one or more of these EPs is usually eliminated on the next word.

When a contact noun is recognised, it is marked in the noun EP as being in reality a relative pronoun. Then the procedure for 942 and 943 above is followed; but in addition, the contact noun is entered as the subject of the relative clause EP.

When a preposition is recognised, the noun EP is reproduced once, because the preposition might be in the noun EP, like dog in a manger, or it might be in a relative clause. For the relative clause path, a preposition EP and a relative clause EP are opened. Only the preposition EP is left open for the next word, which must be a relative pronoun.

For indirect questions,

I don't know which house he bought.

I don't know what he lived in. etc

the treatment is somewhat similar to that for relative clauses.

Pronouns For either a translation or a question-answering program, the noun which the pronoun replaces, called here the replacement noun, has to be identified. In a question-answering program, the reasons are obvious enough. In a translation program, it is necessary for semantic matching and also because in many target languages the gender of the pronoun varies with that of the replacement noun.

The replacement noun might be in the same sentence as the pronoun, or in a previous sentence. Therefore, in dealing with pronouns, the program must be able to refer to preceding sentences. So after ENDR, the essential information for the sentence just processed is extracted from the first chain of EPs and stored. At present, this is only done for one chain of EPs, i.e. one solution. This essential information consists of a tree, containing one code for each word and the relation of each word to the code to which it is attached. Reverting to, The man with a long nose always snores., the information is as follows.

snores.....1.....1175

tense.....2.....tense, mood, code...T 1

man.....3.....211021.....1 1

the.....4.....4032.....3

with.....5.....617.....3

nose.....6.....212.....5

a.....7.....4033.....6

long.....8.....4176.....6

always.....9.....536.....1

The last column points to the code to which the word is attached. The previous column contains any relationship information not implicit in the code itself or, in the case of a pronoun, a pointer to the code of the replacement noun. It is important to notice that the code itself usually does provide the relationship information. For example 61, the first two digits of 'with', specify with some precision the relationship of 'with' to 'man'.

With the preceding sentences available in this form, the processing of a pronoun works as follows. When the pronoun is first encountered for a semantic match, all the possible replacement nouns are found; that is to say, all those nouns which agree in number and person with the pronoun and which are either before the pronoun in the same sentence but not in the same clause, or in a preceding sentence. The program only goes back through the preceding sentences until a suitable noun has been found. If for example there were one or more suitable nouns in the second sentence before the current one,

it would not examine the third sentence before the current one. Consider the following sentences.

The man went into the shop where he had seen the raincoat. He bought a hat and took it away.

For 'he', the only possible replacement noun is 'man' because it is the only noun which agrees in person. For 'it', the program finds 'hat', 'raincoat', and 'shop' as possible replacement nouns. If there were a preceding sentence, it would not bother to search it. Semantic matches are then carried out between 'take' and each of the three nouns and all three nouns are accepted, so they are all entered into the EP after 'it'. But the code ranges for 'shop' are more restricted than for 'hat' and 'raincoat', because the physical-movement meaning of 'take' is excluded with 'shop' because 'shop' is immoveable. When 'away' is read and matched with 'take', all meanings of 'take' except the physical-movement meaning are eliminated. 'Shop' is now left dangling, so to speak, and is eliminated as a possible replacement noun. So when the end of the sentence is reached, there are two possible surviving replacement nouns, 'hat' and 'raincoat'. There is no semantic reason for preferring one of these to the other, because the number of digits matched in the semantic match with 'take' is the same in both cases. Therefore in ENDR a choice is made according to a formula of priorities and 'hat' is selected, as a more recent verb object.

This "formula of priorities", which is only applied if there is no semantic preference for one noun, is probably at

the moment a rather blunt instrument. It is concerned with two factors -- which noun occurred in a later clause, and which noun has the same function as the pronoun; subject, object, preposition object, or object of the same preposition. In the majority of cases it produces the correct answer, but it is possible to think up examples in which it doesn't. With experience of use, the formula will be refined.

A complication is added by the possibility that, when a subject, 'it' may be impersonal. This sense is treated essentially as one possible replacement noun.

There is still work to be done in developing the formula of priorities. CLAM extracts the information required to solve the pronoun problem. The question is, how to use it.

Conjunction No part of the program is more complex than that dealing with conjunction. The principles are clear, even simple, enough; but applying them has demanded a considerable amount of care. Consider the fragment,

He cleaned the carpets in the bedroom and.....

When 'and' is read, the EPs are as follows:

EP1	EP2	EP3	EP4
cleaned	carpets	in	bedroom
he	the	bedroom	the
carpets	in		

All four of these EPs are alive, which is to say that the next word might be a continuation of any of them. On recognising a conjunction, the program looks for possible continuations in all alive EPs, from the beginning of the EP up to the point which has been reached. It carries out the necessary semantic

matches, it opens a new "conjep" or conjunctive EP for each solution, and it enters dummy words in both the conjep and the EPs above it in the chain where necessary. To clarify this procedure, we will consider two possible continuations.

(a).....and I..... 'I' can only be the subject of a verb EP, so the conjep, EP5, must be joined to EP1. The program adds a K entry, and opens EP5 thus:

EP1	cleaned	EP5-----
	he	I
	carpets	EP5 is dependent on EP1 at the subject position
	K5	

(b) .....and curtains. 'Curtains' could be joined to EP2 as the lead, or EP1 as the object. The conjep is attached to the lower EP, EP2, but a dummy word is entered in EP1 and the semantic match is carried out between the dummy word, 'curtains', and the lead of the EP, 'cleaned'.

EP1	cleaned	EP2	carpets	EP5 curtains
	he		the	the[x]
	carpets		in	
	curtains[x]		K5	EP5 is dependent on EP2 at the lead position.

'The' is entered as a dummy word in EP5 because it comes before the point at which EP5 is dependent on EP2. A semantic match is carried out between 'the' and 'curtains'.

'Curtains' might also be the subject of a verb EP, so EP1 is reproduced and another conjep started, attached to the reproduced EP at the subject position, as for.....and I..... above. This path is unlikely to be correct, and will probably

soon be eliminated.

An attempt is also made to attach curtains' to EP4 in the lead position, but it fails because a dummy word curtains' is then put into EP3, and the semantic match between 'in' and 'curtains' is tried and fails.

Now let us see what the EPs look like at the end of a more complex conjunctive sentence:

I, you and Nellie saw, watched and greeted the men, women and tired children.

EP1		EP2		EP5		EP6		EP7	
	saw		I		watched		greeted		men
	I		K3		I[x]		I[x]		the
	you[x]		K4[x]		you[x]		you[x]		K8
	Nellie[x]	EP3	you		Nellie[x]		Nellie[x]		K9
	K5		K4		K6		men[x]	EP8	women
	K6	EP4	Nellie		men[x]		women[x]		the[x]
	men				women[x]		children[x]		K9
	women[x]				children[x]			EP9	children
	children[x]								the[x]
									tired

It will be seen that control passes from the conjeps 5 and 6 up to EP1 before 'men', so that 'men' is entered as a word in EP1. But it is also entered as a dummy word in EPs 5 and 6, and semantic matches are carried out with 'watched' and 'greeted'. Also 'women' and 'children', although only dummy words in EP1, are entered as dummy words in EPs 5 and 6 as well.

A conjep remains open, and the EP on which it depends

remains closed until the last necessary word up to the branch has been filled. If the sentence had read,

I you and Nellie saw, and 'he' watched and greeted..etc.

EP5 would have opened with 'he'. 'I', 'you' and 'Nellie' would not have been entered in it as dummy words. EP5 would have remained open, and EP1 closed until after the lead word 'watched'.

A comma is treated as a possible conjunction or as a possible bracket. Because of the dual role of a comma, the programming associated with it is rather awkward.

To sum up the treatment of conjunction, the possible continuations from a conjunction, particularly if there have been previous conjunctions in the sentence, can be numerous. But by the strict use of dummy entries and their associated semantic matches, false continuations are usually quickly nosed out and eliminated. Also, for the recording of the full meaning of a conjunctive sentence for the purpose of later interrogation, the dummy entry system is of course essential. And in the special case of comparative sentences, it is only by such a system that it can be clearly established exactly what is being compared.

Summary. I conclude this section with an assessment of what the analysis can and cannot achieve. The purpose of analysis might be described as follows: to select, from among all the possible meanings of each word in the passage, its correct meaning in the context, and to determine what semantic relationships exist between which words. CLAM can do this

with considerable efficiency within the confines of a single sentence. It is just beginning to enlarge its horizens to deal with longer texts.

To clarify this statement let us consider the aids which enable us to select one meaning of a word rather than another, and see which of them CLAM applies.

1. Syntactic class. Example: "The car will work when the mechanic finishes his work." Here the word 'work' is evidently a verb on the first occasion and a noun on the second. CLAM can usually deal easily enough with this type of ambiguity.

2. Rules for pronoun antecedents. This has already been discussed at some length.. The rules are both semantic and syntactic. When the rules are determined, CLAM will be in a position to apply them.

3. Semantic restrictions on syntactically associated pairs of words which exclude one meaning. Example: "He took off his grandmother." Here the two word verb 'take off' must mean 'mimic'. The personal subject and the existence of an object excludes the sense of a plane taking off. 'Grandmother' as object excludes the sense of taking off clothes. Such restrictions are the basis of CLAM's semantic match, and ambiguities of this sort are resolved as a matter of course.

4. Semantic restrictions on syntactically associated pairs of words which give preference to one meaning. Example: "I killed the man with a gun." Here, there is a syntactic as well as a semantic ambiguity. It is less straightforward than

the previous example because the ambiguous word is 'with', which might be an instrument preposition attached to the verb 'kill', or a possession preposition attached to the noun 'man'. The semantic relationships which determine the choice, however, only involve 'with' indi ectly. They are between 'kill' and 'gun' in one case, and between 'man' and 'gun' in the other. Normally the preference would be for the instrument interpretation because 'gun' is more strongly associated with 'kill' as an instrument than with 'man' as a possession. CLAM chooses the stronger association by taking the 'deeper' semantic match, or in other words the match involving the larger number of digits. It does this correctly, but as we shall see in a moment, it is not always correct to do so.

5. Remoter contextual environment. Sometimes the factors enabling a choice to be made are more remote from the word in question than in the examples given above. In order to find these factors, a longer journey has to be made into the environment of the word.

Examples: (i) "The mayor hit the alderman so hard that he fell down." The normal rules for selection of pronoun antecedents would prefer 'mayor' as the antecedent of 'he' because it is the subject, but in the environment of hitting, it is much more likely to be the person hit who falls down rather than the hitter, so 'alderman' must be preferred.

(ii) "Two men came in. One had a gun and the other had a knife. I killed the man with a gun." Here 'with' is obviously not an instrument preposition attached to 'kill',

but a possession preposition attached to 'man'. This is so because the definite article 'the' attached to 'man' implies that 'man' has already been defined. But in fact two men have already been defined, and more information is needed to determine which of them is referred to. The only possible additional information which could satisfy this requirement is 'with a gun', which does suffice to distinguish one of the previously determined men. Therefore this phrase must be attached to 'man'.

At present, CLAM could not resolve either of these ambiguities. In order to do so it would need, in the first case, more information about the environment of 'hit' than is contained in the semantic restrictions now at its disposal, and in the second case, both a better memory and a routine for dealing with definition of nouns. Work is in progress on these vital additions. They will involve adding to the type and range of the semantic relationships between pairs of words referred to in the definition of the purpose of analysis given at the beginning of this summary. At present, CLAM only holds semantic relationships between words which are syntactically related. This is not enough. Adding to the types of relationships held, and extending them to pairs of words which are syntactically remote, will greatly increase the scope of the model.

GENERATION OF THE FRENCH TRANSLATION

As shown in the flowchart, the sentence is operated on sequentially by four subroutines--TWEN, ITRN, FRORM and PRIN. Briefly the function of each of these subroutines is as follows.

TWEN examines all the verbs. It welds them (joins auxiliaries to main verbs), and determines their tense in French. This is not of course necessarily the same as in English. Other features of the sentence often have to be examined. Thus, "When he arrives we will meet him", becomes in French, "When he will arrive we will meet him". And "I have been here for five years" becomes "I am here since five years." Gerunds, infinitives and participles are also dealt with by TWEN. It may well be asked why the weld part of this routine is thus left until the French generation. Should it not be done during the reduction of the English sentence to base form? The answer is that logically it should, and it will sooner or later be transferred, probably to ENDR. But at present it doesn't matter. The part of the program described in the section on pronouns which stores the base form of the last sentences is in fact performed after the French translation has been generated, and therefore, after the verbs have been welded.

ITRN takes each word in the sentence in turn. It finds the code number in FRILE, the French dictionary file, and extracts the French word(s). Sometimes of course there is

more than one. Sometimes there is zero because the English word does not have to be translated. Any particular French word may not have the same function in the sentence as the English word. In such cases, the French word entry in FRILE is followed by a code which specifies the word's function in relation to the English word being translated. For example, if 212237 is the code for 'potato', the FRILE entry will be 212237 POMME F DE 6 TERRE 6x2. The F after POMME shows that it is feminine. The 6 after DE shows that its function is as a preposition in the EP of which POMME is the lead. The 6x2 after TERRE shows that it is the object in the EP of which DE is the lead.

Sometimes it is necessary to go up the tree. For example Y1x5 means an adverb (5) in the verb EP (1) of which the English word is a subsidiary (Y). It is thus possible to generate a French sentence of a radically different shape from English.

ITRN also finds a French sequence code for each word. This is a code which provides the ordering of words within an EP. All lead words have the code 200. A pre-noun adjective may have a code 140, and a post-noun adjective 350. So these codes do not determine what is the actual sequence of words in the sentence, but they do provide the basic information from which the sequence is derived in FRORM.

FRORM first derives the actual sequence of words in the sentence. It then takes each French word and puts it into the

correct form. Obviously the most arduous part of this task is finding the forms of the verbs. FRORM refers to tables which contain the verb endings for both irregular and regular verbs, and the irregular feminine and plural endings for nouns and adjectives.

PRIN prints the French translation, having made any necessary elisions. If there is more than one solution, it prints alternative translations of particular words on subsequent lines or, if appropriate, it will print complete alternative sentences.

CONCLUSION

Programming Details and Future Developments

Programmers may be interested in some details. The program runs on a 360-40 using 146K of core store. The program is written in FORTRAN IV, not an ideal choice but the best available in the circumstances. The reduction of the English to base form requires about 6,000 instructions, and the French generation about 2,500. At present all the files are kept in core store except for the two large dictionary files VOCAB and FRILE, which are accessed on disk. It will eventually be necessary to keep JSP also on disk.

At present the processing takes about 15 seconds per word on average, of which READ takes 40%, the semantic and syntactic analysis about 20%, and the French generation 40%. No serious attempt has yet been made to optimise the program and this time could certainly be reduced. But the reduction would

be offset by the eventual need to keep JSP on disk. So as a practical proposition for translating texts, it would be necessary for the processing time to be reduced by a factor of about 10. Presumably this will come sooner or later with improvement in hardware.

There are certain improvements which would have to be made to the program before it could be used, apart from the extension of the vocabulary. Most obvious:

(a) there are some syntactic structures such as inversion after negatives which the program does not at present recognise;

(b) a selection routine must be incorporated in ENDR to choose between alternative solutions if more than one emerges;

(c) if no solution emerges the program should try again, selectively suppressing semantic matching, allowing words to be used outside their normal sense;

(d) the sizes of some of the temporary stores would have to be increased.

No particular difficulty is anticipated with any of these developments, in that they involve no methodology fundamentally different from what has already been applied. It is primarily a matter of time and priorities. However with a fifth development, namely the extension of the memory as outlined at the end of the section on analysis, new ground must be covered, and work on this is at present in progress.

APPENDIX

Coding System : Principal Categories

Digit	1st	2nd	3rd
	1 verb	1 intransitive	
		2 noun object	
		3 clause predicate	1 noun + part part.
			2 noun + to + infin.
			3 noun + gerund
			5 noun clause
		4 verb sequel	1 infinitive
			2 to + infinitive
			3 gerund
		5 noun + clause predicate	1 noun + infinitive
			2 noun + to + infin.
			4 noun + prep. + gerund
			5 noun + noun clause
		6 complement sequel	
		7 be (pres. cont.)	
		8	1 be (passive)
			2 have (pres. perf.)
	2 noun	1 concrete	1 animate
			2 inanimate
		2 abstract	
	3 pronoun		
	4 adjective	0 qualify concrete or abstract noun	

Digit	1st	2nd	3rd
		1 qualify concrete noun	0 animate or inanimate
			1 animate
			2 inanimate
		2 qualify abstract noun	
		4 question	
		5 possessive	
	5 adverb	1 time	
		2 place	
		3 purpose	
		4 question	
		5 manner	
		6 degree	
		7 probability	
		8 frequency	
	6 preposition	1 predetermined	1 by verb
			2 by noun
			3 by adjective
		2 post determined	1 time
			2 place
			3 purpose
			4 reason
			5 manner
			6 instrument

Digit	1st	2nd	3rd
			7 association
			8 past
			9 concession
			A subject matter
	7 conjunction	1 link	
		2 contrast	
		3 comparison	
	9 clause word	2 noun clause	
		4 relative clause	
		6 adverbial clause	1 time
			2 place
			3 purpose
			4 reason
			5 manner
			8 condition
			9 concession

American Journal of Computational Linguistics Microfiche 49 : 53

State University
of New York

RFP

REQUEST FOR PROPOSAL

Federal Research & Development by Contract

WASHINGTON OFFICE

STATE UNIVERSITY OF NEW YORK

SEPTEMBER 1974

AJCL EDITOR'S NOTE

The document reproduced on these frames came to the Editor's attention recently, in spite of the publication date. AJCL thanks the State University of New York, copyright holder, and Mr. Mort Grant, Director of the Research Foundation of SUNY; Ms. Winifred R. Widmer, Assistant Director for Administration; Mr. William F. Claire, Director of the SUNY Washington Office; Mr. Jim Kalas and Ms. Susan G. Sorrels of that Office; for their several contributions to the appearance here of RFP.

Some of the names and telephone numbers must no longer be correct; but ACL and AJCL do not have the means to bring them up to date. The general understanding of the system which this document provides is valuable to any ACL member who chooses to make use of it. Broader Federal support for the use of computers in linguistics is probably the only way to bring the field to a much higher level of activity.

--DGH

Individual copies are available to all authorized State University of New York personnel free of charge. Bulk orders, or other requests for copies can be arranged at a cost-of-printing charge of $1.50 per copy. All requests regarding this publication should be directed to the Washington Office, State University of New York, Suite 500, 1730 Rhode Island Avenue, N.W., Washington, D.C. 20036 (202, 659-2330). Checks should be made payable to the Research Foundation of State University of New York.

William F. Claire, Director

Susan G. Sorrels, Editor

Carole K. Combs, Administrative Assistant

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INTRODUCTION

In view of an increasing interest in government agencies in pinpointing their research needs, the Washington Office of State University of New York feels that it is appropriate for its campuses to familiarize themselves with what is commonly called the RFP process. The "request for proposal," or the government way of saying that it is putting out bids to fulfill a specific need, is becoming something that all campuses should be aware of in their efforts to secure all possible funding for research and development from outside sources. Federal contracting out, as it were, can be a complicated process, but we hope that potential investigators will regard this information as preliminary. After that, there isn't any substitute for the amount of work involved.

This booklet is designed to give campus representatives an overview of the agencies involved, as well as an understanding of and explanation of the RFP contract mechanism. We have listed 15 separate agencies currently involved in this contract mechanism, their interest and appropriate addresses for more information. We have also included a glossary of terms as a guide and an index of the various offices and bureaus within each of the 15 agencies.

The time span from inception of an idea to actual publication is always a lengthy one and many people have been involved with this report. William Hedberg, Susan Sorrels, Jim Kalas, and Carole Combs have all participated in its development. Bryan Swartz, who joined our office in the summer of 1974 as an intern from the Stony Brook campus, deserves special praise for his coordination of many activities leading to the publication of the book. Without his dedication to the project, it might have been delayed considerably. We are grateful to all of these people for their assistance. We hope that the book will prove a valuable working guide for anyone interested in the contract system. The Washington Office would be pleased to provide additional information about the agencies involved.

William F Claire
Director, Washington Office

I. FEDERAL PROCUREMENT FOR RESEARCH AND DEVELOPMENT: AN EXPLANATION OF THE RFP CONTRACT MECHANISM

Each year the federal government contracts for billions of dollars of work to support efforts deemed to be in the national interest. A significant percentage of the contract services are in the form of Research and Development (R & D) or programmatic work which colleges and universities are particularly well-suited to perform. The government commits these funds in either of two ways: grants or contracts.

University researchers are generally more familiar with the grant procedure than with the contract procedure. Under a grant program, a given federal agency is authorized to grant funds to non-profit institutions, frequently educational institutions, for the purpose of supporting research or a program in a given general area. A body of general conditions are established by the Congress and refined by the applicable agency to set parameters for the program as a whole. A specific grant for a program can be made so long as it fits within the general standards (the Guidelines) of the program and meets whatever qualitative standards for review that have been established.

Since grant funds, particularly in research areas, have been increasingly competitive in recent years, the university community is turning its attention to potential support through the contract mechanism. A contract, unlike a grant, is generally awarded for the purpose of meeting a specific requirement that a federal agency has determined to be important to the achievement of the agency's responsibilities. The contract will tend, therefore, to be specific in terms of the agency's needs, and in the case of research, will usually be for the purpose of "applied" rather than "basic" research. The contract, also unlike the grant, can be negotiated with any organization that is legally constituted to do business with the government, whether non-profit or profit-making.

Government procurement in its present massive scope is a relatively new phenomenon, having emerged in its present form in the past quarter of a century. Each of the many federal agencies involved in procurement - and most are - developed a set of standards and procedures to administer the contracting process. While the procedures used by any given agency tend to be relatively orderly in terms of that agency's requirements, they will not necessarily conform to the practices of another agency. Looking at the federal government as a whole, however, the set of practices is varied, highly technical and often confusing. The general descriptions offered in this statement, therefore, are subject to the differing qualifications and refinements established by individual government agencies.

In recent years there has been an attempt to bring inter-agency consistency to the procurement process. A special government task force has recommended legislation which would bring uniformity in procurement policy. Congress is considering such legislation, which will be discussed later.

Basic contractual agreements with the federal government are developed in one of four ways:

A. *Sole Source Procurement.* The government negotiates with one and only one provider on the grounds that the product or service is uniquely provided by the organization in question.

B. *Single Source Procurement* The government negotiates with one and only one provider in instances where there could be competitive bids but because of factors such as geography, location, convenience or special urgency competitive bidding is unwarranted.

C. *Competitive Negotiation* In instances where providers are few and known to the government, competition is limited to the known providers and publicity regarding the availability of a contract is not required.

D. *Open Competition* Contracts are let by open bid, utilizing the mandatory provisions for advertising publicly the availability of the contract, and open solicitation of proposals as described later.

In addition to the four types of contractual processes, there are special types of contractual arrangements for special purposes. For university representatives, the *Open* and *No Cost* Contracts are of particular interest. These contracts permit the exchange of equipment, particularly scientific equipment, and documents for specified purposes without actual fiscal transaction.

Of the various contractual patterns, the Open Competition is becoming the most common contract mechanism. Since the government purchases goods and services on a daily basis and in amounts totaling billions of dollars annually, the problem for potential investigators is how to discover that a contract of interest will be let and whether their organizations have sufficiently reasonable chances of winning the contract to justify the extensive and uncompensatable effort required to apply.

Each competitive contract let by the government must be announced as open to competition. The announcement is in the form of a *Request for Proposal* (RFP). The announcement must be published in the journal that has become the primary source for all contract information: the *Commerce Business Daily*. The *Commerce Business Daily* is published in Chicago as a service of the Department of Commerce. (It may be ordered from the Government Printing Office, Washington, D.C.; the subscription rate is currently $63.50 per year.) The *Commerce Business Daily* has a small staff and consequently must publish RFP announcements as they are written by the contributing agency. As a result, information that is published regarding a given competition is often scant and late, with proposal deadlines sometimes only a matter of days away from the date of publication. Frequently a notice will indicate the need to send for more detailed information provided by the agency offering the contract. Writing for the necessary information cuts into the short time available for preparation of a proposal to meet a deadline date.

Alternately, most agencies provide an additional advantage to prospective bidders in the form of "Bidders Lists." All current prospective bidders on a "Bidders List" are

notified of a pending RFP, generally at the same time the *Commerce Business Daily* is notified, thus giving the bidder on the list the advantage of several days.

In order to be included on a "bidders list," an investigator must contact the agency with which he intends to do business and request an application. Most agencies now use Standard Form 129* for placement on bidders lists. While there is some inter-agency cross-listing of bidders, for the most part applicants must expect to submit Standard Form 129 separately to each agency for placement on a bidders list.

There are some difficult problems in the mechanics of the contract process of which interested college and university representatives should be aware. For example, government agencies have established the rule that each organization on a "bidders list" must respond either positively or negatively to every RFP it receives. If an organization fails to respond to an RFP with at least a notice of intent, it is removed from the "bidders list." Maintaining status on a "bidders list" therefore can become a tedious administrative task justifiable only to those organizations that are geared to a heavy volume of government contracting. The "bidders list" does permit the applicant organization to indicate the types of proposals in which it is interested and its capacities to perform tasks, however, so that RFP's are sent to the organization only when the RFP is relevant to the organizations' capabilities. Some of the administrative burden on prospective contractors is eliminated by this procedure.

Even in the best of circumstances, however, bidders frequently have as little as two weeks to prepare a proposal. Generally the competition has the same time constraints, but the process does require staff who are available and who can "drop everything" in order to meet a proposal deadline. Private research corporations and consulting firms can administer their work so that they may respond to proposal preparation on short notice; responding quickly to an RFP is frequently more difficult for university investigators with heavy commitments to teaching and other university-related activities.

Except for the time constraints under which one must work, the preparation of contract proposals differs little from the preparation of grant proposals. In one sense, the preparation of a contract proposal is easier because specific terms and objectives are generally stated in the RFP. The proposal is frequently a statement of the methodology and procedures for achieving prescribed objectives. On the other hand, the contract leaves little latitude for the creative investigator to determine the character of the research to his own standards. The agency sponsoring the RFP sometimes employs qualified persons who can state a valid set of objectives and specifications for the contract; sometimes, however, it does not. It might be necessary for the response to an RFP to contain arguments for altering objectives and specifications that diplomatically demonstrate how the governments' interests will be served.

Contracting also can take place by means of an "Unsolicited Proposal." The investigator submits a proposal which he has initiated to an appropriate federal agency and the agency can respond at its discretion if the proposal meets agency needs. Generally the unsolicited proposal rises as a result of prior informal discussions between the investigator and

*See Appendix A

the government agent.

When a contract has been awarded by a particular agency, the investigator's fiscal agent must meet with the agency's contract officer to negotiate the final terms of the contract. The type of negotiation will depend upon whether the contract is *Fixed-Price* or *Cost-Reimbursable*. A Fixed-Price contract is one in which the organization and the agency agree upon contract terms for a pre-determined fixed cost. Once the Fixed-Price contract is signed, the organization must meet the terms of the contract for the price regardless of circumstances. The fixed-price contract is generally more appropriate for products than for services.

The Cost-Reimbursable contract is negotiated on the basis of cost estimates of monthly operating levels. The monthly operating level will be the sum of allowable costs on a monthly basis during the time of the contract. It is understood that the final price of a Cost-Reimbursable contract can go up (Cost Overrun) or down from the original estimate as a function of allowable costs actually incurred.

The Fixed-Price contract is easier to administer and simplifies record-keeping. The reason for this is that once the price is set the government is relatively unconcerned about how contract expenditures break down by category or line items. With the Cost-Reimbursable contract, complete documentation by cost category must be strictly maintained since the documentation is the sole basis for reimbursement for expenditures under the contract The administration of the Cost-Reimbursable contract is much more tedious, therefore, than is the case for the Fixed-Price contract, but does have the advantage, given adequate book-keeping, of entailing no risk to the contractor.

Because the total cost of a Cost-Reimbursable contract is an estimate rather than a firm figure, the awarding of a competitive bid can be based on factors other than the "bottom line" cost. Clearly the level of operational cost will be a significant factor in determination of an award, but in the absence of strict Fixed-Cost, the way is opened for numerous judgment factors to affect the decision of award. While the government has tried to establish safeguards against arbitrariness and favoritism, the latitude in decision-making is still wide in open competition contracting and even wider in the other contractural forms.

WHAT CONGRESS IS DOING ABOUT THE PROCUREMENT PROCESS

What has happened over the years is that federal procurement has become a big business. Contracts for goods, services (which include research and development), and facilities have reached $60 billion annually. Although no statistics are available to describe the amount of federal contracts awarded colleges and universities, we do know that college and university participation in federal research and development efforts represents approximately 14% of the total federal investment in R & D, and that an increasing amount of that money is awarded by contract.

What is disturbing is that despite the magnitude of federal expenditures by

contract, the government has no single office responsible for policies to govern the procurement process, and no single source to provide guidance and information about federal procurement laws and regulations. In fact, the federal government has no clear-cut definition for the terms grant and contract.

As a result, we have been faced with confusing and complicated rules, excessive paperwork, favoritism and abuses in procurement practices, cost overruns, and many other factors that led to a thorough study of procurement practices by the Commission on Government Procurement.

The results of the Commission's work is now demonstrated in the Congress. Using the Commission's report and recommendations as a blueprint, Congress is considering legislation to address procurement problems, including two major bills of interest to State University of New York.

One measure, certain to bring about fundamental changes necessary to improve the system, would establish a central procurement policy office in the Executive Office, which would provide overall guidance and direction for federal procurement policy The office would establish a government-wide system of uniform procurement regulations, coordinating policies and regulations of federal agencies, and exercising leadership in monitoring and revising future policies and procedures. The Administrator would be appointed by the President and approved by the Senate. All major decisions by the Office would be approved by Congress.

At this writing, a House-Senate conference committee is considering the measure. Sources indicate that the bill should be agreed to in the near future and will be sent to the President for his signature.

The other major procurement bill (S 3514, HR 9060) now under consideration by Congressional committees hopefully would eliminate the present confusion among federal agencies in determining whether the legal instrument used to support the desired goods or services should be a grant or contract, or cooperative agreement, simply by defining the terms clearly. Under both House and Senate versions of the bill, the contracts would be used whenever the principal purpose of the agreement would be to purchase goods or services "for the direct benefit or use of the federal government" for "ultimate public use." Grants would be used as the legal instrument when the objective would be "to accomplish a public purpose authorized by federal statute" rather than for direct use by the federal government. Cooperative agreement would be used to apply whenever the activity would be authorized by federal statute but "substantial involvement" of the federal agency is also necessary.

At this writing, the bill is under consideration by House and Senate Government Operations Committees. Since the legislation would directly affect agreements for research and development by State University of New York and federal agencies, it is recommended that interested persons remain aware of the measure's status.

II. ALPHABETICAL LISTING OF FEDERAL AGENCIES THAT CONTRACT FOR RESEARCH AND DEVELOPMENT

DEPARTMENT OF AGRICULTURE

Agricultural Research Service

Principal Interests. Physical, biological, chemical and engineering research; includes the 11,000 acre Agricultural Research Center, Beltsville, Maryland. Clothing and housing research, household economics, and human nutrition research. New and improved industrial and food products and processing methods for agricultural commodities. Soil and water, crop, animal husbandry, entomology and agricultural engineering research.

Address.
Administrator, T.W. Edminster
Agricultural Research Service
14th and Independence Avenue, S.W.
Washington, D.C. 20250
Tel: 202, 447-3656

Economics Research Service

Research in farm and marketing economics, resource development, economic and statistical analyses, foreign trade development.

Address:
Administrator, Quentin M. West
Economics Research Service
Department of Agriculture
14th and Independence Avenue, S.W.
Washington, D.C. 20250
Tel: 202, 447-8104

Forest Service

Principal Interests: Timber, forested watershed and rangeland management and protection; forest product utilization and marketing.

Address:
Chief, Forest Service, John McGuire
Department of Agriculture
14th and Independence Avenue, S.W.
Washington, D.C. 20250
Tel: 202, 447-6661

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Address:
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Department of Agriculture
14th and Independence Avenue, S.W.
Washington, D.C. 20250
Tel: 202, 447-6661

Office of Sea Grant

Interests: Administers and directs the National Sea Grant Program. This program provides support for institutions engaged in comprehensive marine research, education, and advisory service programs, supports individual projects in marine research and development, and sponsors education of ocean scientists and engineers, marine technicians, and other specialists at selected colleges and universities.

Address
Administrator: Dr. Robert M. White
National Oceanic and Atmospheric Administration
6010 Executive Boulevard
Washington Science Center
Rockville, Md. 20852
Tel: 301, 496-8111

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE AIR FORCE

Air Force Systems Command

Interests Responsible for the rapid advancement of aerospace technology and its adaptation into operational aerospace systems.

Address:
Air Force Systems Command Headquarters
Cmdg. Gen: Gen. George S. Brown
Andrews Air Force Base, Md. 20331
Tel: 301, 981-9111

Air Force Office of Aerospace Research

Interests: Air Force's basic research organization. Four major areas: life, mathematical, engineering, and physical sciences.

Address:
Exec. Dir: W. J. Price
Directorate of Procurement (CCB),
Air Force
Office of Scientific Research
1400 Wilson Blvd.
Arlington, Va. 22209
Tel: 703, 545-6700

DEPARTMENT OF THE ARMY

Army Biological Laboratories

Interests: Biological research and development.

Address: Cmdg. Officer: Col. P.Olenchuk
Scientific Director: Dr. Riley D. Housewright
Army Biological Laboratories
Fort Detrick, Frederick, Md. 21701
Tel. 301, 663-4111

U.S. Army Engineer Topographic Laboratories

Interests: Advanced research in general fields of geodesy, engineer intelligence, and mapping.

Address
Cmdg. Officer: Col. John R. Oswalt
Army Engineer Topographic Laboratories
Fort Belvoir, Va. 22060
Tel 703, 781-8500

Army Mobility Equipment Research and Development Center

Interests Research, development and engineering in support of Army surface mobility.

Address.
Comdg. Officer: Col. Bennett L. Lewis
Army Mobility Equipment Research and Development Center
Fort Belvoir, Va. 22060
Tel: 703, 664-5251

DEPARTMENT OF THE NAVY

OFFICE OF NAVAL RESEARCH

Naval Research

Interests: Acoustics; geography, geophysics, metallurgy, chemistry, including physical, organic, inorganic and colloid and propulsion chemistry, solid state physics, nuclear physics, electronics, mathematics, logistics and mathematical statistics, fluid dynamics, physiology, biochemistry, microbiology, medicine, and dentistry, biology, group psychology, physiological psychology, engineering psychology and personnel training.

Naval Applications

Interests: Research and exploratory development in the field of aircraft and missile systems, air warfare, surface vessel problems, amphibious warfare systems, underwater weapons, underwater communications and navigation, noise reduction in naval vessels, and advanced submarine problems.

Naval Analysis

Interests: Preliminary investigations of systems and warfare problems; directs and monitors systems and warfare analysis studies undertaken by the Naval Warfare Research Center and selectively sponsored under contract with industry, research institutes, and universities.

Address:
Chief of Naval Research
Department of the Navy
800 North Quincy Street
Arlington, Va. 22217
Tel: 703, 692-4609

ENVIRONMENTAL PROTECTION AGENCY

Interests: The Agency generates research and development needs in the areas of air and water pollution control and abatement, pesticides research and control, solid waste management, noise pollution, and radiation monitoring and control. In all areas of EPA concern, there is need for further research into the effects of pollutants on the environment and human health.

Address.
Stanley M. Greenfield
Assistant Administrator for Research and Monitoring
Office of Research and Monitoring
U.S. Environmental Protection Agency
Waterside Mall, Room 3202
Washington, D.C. 20460
Tel: 202, 755-2600

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

NATIONAL INSTITUTES OF HEALTH

Interests. Conducts laboratory and clinical research on the prevention, diagnosis, and treatment of diseases and disability. Supports medical research in the nation's non-profit biomedical research institutions. Generally the Institutes conduct and support research and the Divisions provide administration and service. They are listed below.

Address.
Dr. Robert Stone, Director
National Institutes of Health
Building 1
900 Rockville Pike
Bethesda, Md. 20014
Tel: 301, 496-2433

National Institute of Allergy and Infectious Diseases

Interests: Research and development on infectious diseases and immunological phenomena of man with special emphasis on vaccines and other immunizing agents, immunosuppressive drugs, drugs for prevention and treatment of virus diseases, test systems and reagents for identifying tissue antigens and disease-producing agents. Current emphasis is on the development of vaccines for viral and bacterial diseases, antiviral substances and tissue typing for human organ transplantation.

Address:
Dr. Dorland J. Davis
Assistant Scientific Director for Collaborative Research, NIAID
National Institutes of Health
Building 31, Room 7A-03
Bethesda, Md. 20014
Tel: 301, 496-2263

National Institute of Arthritis and Metabolic Diseases

Interests Conducts, fosters, and coordinates research into the causes prevention, diagnosis, and treatment of arthritic, rheumatic, collagen, and metabolic diseases.

Address.
Contracting Officer, NIAMD
National Institutes of Health
Room 10A-52, Building 31
Bethesda, Md. 20014
Tel: 301, 496-5877

National Institute of Child Health and Human Development

Interests. Research and development programs in areas relating to maternal health, child health, human growth and development, maturation and the aging process, reproductive and perinatal biology, mental retardation and population problems.

Address:
Director, National Institute of Child Health and Human Development
National Institutes of Health
Building 31, Room 2A05
Bethesda, Md. 20014
Tel: 301, 496-3454

National Institute of Dental Research

Interests: Conducts, assists, and fosters research and training in matters relating to the causes, prevention, diagnosis, and treatment of dental diseases and conditions.

Address.
Director, National Institute of Dental Research
Building 30, Room 132
9000 Rockville Pike
Bethesda, Md. 20014
Tel: 301, 496-3571

National Institute of Environmental Health Sciences

Interests: Basic research on the biological effects of environmental hazards on man.

Address:
Director, National Institute of Environmental Health Sciences
P.O. Box 12223
Research Triangle Park, N.C. 27709
Tel: 919, 549-8110

National Institute of General Medical Sciences

Interests. 1. Research, development, and evaluation of rapid, reliable automated systems and instruments, for potential application in all aspects of clinical chemistry, toxicology, hematology, microbiology, virology, blood banking, etc. Subject areas of interest include sample collection and labelling techniques, new or improved analytical methods, data handling and reduction techniques for compact computers, miniaturized and portable test systems for emergency use, all intended to increase reliability, throughout, and clinical significance.

2. Research, development, and evaluation in all aspects of therapeutic drug use, including synthesis, testing, assays in body fluids, and surveillance for effectiveness, side effects, and drug interactions. The principal aim is to promote safer and more effective use of drugs. Related problems include dose-response patterns, kinetics of uptake, distribution, and elimination, metabolic transformations of administered drugs, and quantitative analytical methods and instruments for identification and assay.

3. Research, development, and production in areas where technological constraints impede progress in genetics research. Representative problem areas include isolation, synthesis, separations, purification, and production procedures for material and synthetic genetic materials such as nuclear acids, synthetic genetic

materials such as nuclear acids, related enzymes, tissue culture cells, genetically determined animals, etc.

Address.
Director, National Institute of General Medical Sciences
National Institutes of Health
Building 31, Room 4A52
Bethesda, Md. 20014
Tel: 301, 496-5231

National Institute of Neurological Diseases and Stroke

Interests: 1. Research on diseases of the nervous and sensory system with emphasis upon: cerebrovascular disorders, epilepsy and related convulsive disorders, head and spinal cord trauma, infections of the nervous system, debilitating diseases of viral etiology, brain death, and cerebral palsy and other neurological disorders of infancy and early life.

2. Development and experimental application of new or advancing technologies for the study of the nervous and sensory system and related disorders.

3. Utilization of unique or unusual services to support research programs, such as: computer programming and data processing; animal housing and maintenance; preparation of tissue cultures, viral antigens, and other research products; and the provision of support for highly complex field research.

Address.
Director, National Institute of Neurological Diseases and Stroke
National Institutes of Health
9000 Rockville Pike, Building 31, Rm. 8A52A
Bethesda, Md. 20014
301, 496-3167

National Cancer Institute

Interests. The Institute has three principal scientific program areas, which accomplish a significant part of their research programs through collaborative research, under contract with profit-making, nonprofit, and educational institutions as follows:

1. *Etiology Program Area* - Plans and directs a program of laboratory, field and demographic research on the etiology and natural history of cancer; evaluates environmental carcinogenic hazards, mechanisms of cancer induction, and the natura history of neoplasms; and serves as the focal point for the Federal Government on the synthesis of clinical, epidemiological and environmental data relating to etiology.

2. *Chemotherapy Program Area* Plans, directs and coordinates the Institute's integrated cancer chemotherapy activities, including intramural laboratory and clinical studies, contractor research, and research conducted in cooperation with other Federal agencies; participates in evaluation of grant applications in the field of cancer chemotherapy, and plans and directs the research aspects of the Baltimore Cancer Research Center, a collaborative effort between the Division of Hospitals and the NCI.

3. *General Laboratories and Clinics Program Area* - Plans and directs the Institute's general (as distinguished from specifically targeted) laboratory and clinical research activities.

Address
Chief, Research Contracts Branch, NCI
Building 31, Room 10A03
Bethesda, Md. 20014
Tel· 301, 496-1673

National Eye Institute

Interests. Development of techniques, instrumentation and other resources which will improve the prevention, diagnosis or treatment of glaucoma, retinal and choroidal

disease, corneal disease, cataract, congenital and developmental abnormalities and other vision related health problems.

Address:
Associate Director for Extramural and Collaborative Programs
National Eye Institute
Building 31, Room 6A-04
Bethesda, Md. 20014
Tel: 301, 496-4903

National Heart and Lung Institute

Interests: Research in lipid metabolism; materials that are compatible with blood and other tissues, instrumentation for improved diagnosis and monitoring of patients, and devices for the treatment of patients with inadequate or failing circulatory or pulmonary functions; cause, treatment and prevention of myocardial infarction; supply,. safety, utilization, distribution and use of blood; respiratory diseases; and sickle cell anemia.

Address:
Director, National Heart and Lung Institute
Building 31, Room 5A52
Bethesda, Md. 20014
Tel: 301, 496-5166

National Library of Medicine

Interests Application of advanced communication and computer techniques to meet the information needs of health care professionals. Information storage and retrieval systems, microfilm systems, clearinghouses, data banks, time-sharing computer networks. Cable, microwave and satellite communications networks for voice, video, and data transmission. Computer and communications terminals, facsimile, slow-scan video Evaluation of interation of communications technology and health care systems.

Address.
Director, National Library of Medicine
Room M-101
Bethesda, Md. 20014
Tel: 301, 496-6221

Clinical Center

Interests. Provides patient care in support of the clincial investigations conducted by the categorical Institutes.

Address:
Director, Clinical Center
National Institutes of Health
9000 Rockville Pike
Building 10, Room 1N212
Bethesda, Md. 20014
Tel. 301, 496-4114

Division of Research Services

Interests Provides facilities, equipment, and a wide variety of scientific and technical services essential to the needs of the medical investigators and research administrators at NIH.

Address
Director, Division of Research Services
National Institutes of Health
9000 Rockville Pike
Building 12A, Room 4007
Bethesda,, Md. 20014
Tel: 301, 496-5793

Division of Research Grants

Interests· Develops, coordinates, and implements policies and procedures governing management of Public Health Service extramural grants programs.

Address:
Director, Division of Research Grants
Westwood Building
5401 Westbard Avenue
Room 452
Washington, D. C. 20016
Tel: 301, 496-7381

Division of Research Resources

Interests: Aids institution in the construction of new and remodeled medical research facilities; helps them establish and operate a number of general clinical research centers; supplies a variety of unusual and highly special research services and equipment such as computers; supports regional primate research centers, and stimulates well-balanced institutional research programs through grants for general biomedical research support

Address.
Director, Division of Research Resources
National Institutes of Health
9000 Rockville Pike
Building 31, Room 5303
Bethesda, Md. 20014
Tel: 301, 496 5605

Division of Computer Research and Technology

Interests: Plans and conducts research, developmental, and demonstration programs in mathematical and other computer-related sciences, including information processing, in support of NIH programs.

Address:
Director, Division of Computer Research and Technology
National Institute of Health
9000 Rockville Pike
Building 12A, Room 3033
Bethesda, Md. 20014
Tel: 301, 496-5703

Fogarty International Center

Interests Provides the facility for discussion, study and research relating to the development of science internationally as it pertains to health, coordinates the NIH international activities.

Address
Director, Fogarty International Center
National Institutes of Health
9000 Rockville Pike
Building 31, Room 2C02
Bethesda, Md 20014
Tel: 301, 496-1415

HEALTH RESOURCES ADMINISTRATION

Bureau of Health Services Research

Interests: Supports research concerning the organization, financing, and utilization of health services research. Interested in new methods or improving old methods. Primary emphasis in five broad categories: (1) Planning, regulation, and licensure; (2) Productivity of health services, (3) Economic analysis; (4) Quality of health care; 5) Health care data and information systems.

The Bureau is divided into the following major divisions:

Division of Health Care Information Systems and Technology

Division of Health Systems Research and Development

Division of Health Services Design and Development

Division of Health Services Quality Research

Division of Health Services Research and Analysis

Division of Long Term Care

Contact:
James Wechsler
Contract Liaison
Tel: 301, 443-3185

Address:
Bureau of Health Services Research
Parklawn Building, Room 1515
5600 Fishers Lane
Rockville, Maryland 20852
Tel: 301, 443-2770

Bureau of Health Resources Development

Interests: Each division has its own contracting interests. See below.

Division of Associated Health Professions
Interests: Pending legislative authority.
Contact: Elizabeth Wolfson
Tel: 301, 496-6787
Address: See below

Division of Dentistry
Interests. Supports research relating to dental education, practice, manpower and service.
Contact: Alys F. Jacobs
Executive Assistant
Tel: 301, 496-4775
Address: See below

Division of Nursing
Interests: Research includes nursing practice, nursing educational programs, organization and delivery of nursing services to patients, and nursing as an occupation. Research also includes studies in various medical and other specialities related to nursing care and related health programs.
Contact: Jessie Scott
Director, Division of Nursing
Tel. 301, 496-1418
Address. See below

Division of Medicine
Interests Medical evaluation, projects concerning health care delivery, educational technology, curriculum development, and institutional development among others.
Contact. Dr. Robert Knouss
Tel. 301, 496-5608
Address. See below

Division of Comprehensive Health Planning
Interests. Supports research in two major areas: (1) technical assistance; (2) health planning technical development. Development approach to using new tools and methodology Planning for services and facilities.
Contact: Mr. Robert Crane
Tel: 301, 443-4614
Address See below

Address for divisions above.
(Name of Division)
Bureau of Health Resources Development,
9000 Rockville Pike
Bethesda, Maryland 20014
Tel: See division.

National Center for Health Statistics

Interests: The Center conducts research on health statistics, data collection, and dissemination.

Address. Helen Johnson
National Center for Health Statistics
5600 Fishers Lane
Rockville, Maryland 20852
Tel: 301, 443-6315

ALCOHOL, DRUG ABUSE, AND MENTAL HEALTH ADMINISTRATION

National Institute of Mental Health

Interests: Research in all mental health-related matters, including child abuse, manpower training, the aged, community mental health centers, among others.

Contact: Mr. John Miller
Contracts Management Section
Parklawn Building, Room 7C 23
5600 Fishers Lane
Rockville, Maryland 20852
Tel: 301, 443-2696

National Institute of Alcohol Abuse and Alcoholism

Interests. Supports research concerning treatment evaluation, clinical and non-clinical studies relating to alcohol and health, problems, projects and special studies on the alcohol consuming population such as drunken drivers, poverty-stricken alcoholics, convict alcoholics, and the inebriated.

Address:
National Institute of Alcohol Abuse and Alcoholism
Contracts Management Branch, Room 16C21
Parklawn Building
5600 Fishers Lane
Rockville, Maryland 20852
Tel: 301, 443-1191

National Institute on Drug Abuse

Interests (1) Research and development: emphasizes development of new methods of treatment for addiction of a broad range of addictive agents; (2) Training and public education: supports efforts to develop and install systems related to the integrated drug abuse management information systems.

Address: Contracting Officer
Contracts Management Branch
National Institute on Drug Abuse
11400 Rockville Pike
Rockville, Maryland 20852

FOOD AND DRUG ADMINISTRATION

Interests: Primarily concerned with research and development studies in radiological health, biologics, drugs, veterinary medicine, medical devices, and cosmetics. Colleges, universities, and other education institutions represent most FDA contracts.

Contact: Mr. Floyd Sundquist
Director of Contract and Grant Administration
Food and Drug Administration
5600 Fishers Lane
Rockville, Maryland 20852
Tel: 301, 443-6890

OFFICE OF EDUCATION

Interests: Research and development in the field of educational methodology and techniques, including curriculum development, career education models, and collection and analysis of educational data.

Address:
Director, Contracts and Grants Division
Office of Education, Department of HEW
Federal Office Building, No. 6
400 Maryland Avenue, S.W.
Washington, D.C. 20202
Tel: 202, 245-8160

SOCIAL AND REHABILITATION SERVICE

Interests: Research, development, and evaluation of social programs in the areas of aging, rehabilitation, community services, Medicaid. youth development and delinquency prevention.

Address: Associate Administrator for Planning, Research and Training
Social and Rehabilitation Service
Room 5050, HEW South Building
330 Independence Avenue, S.W.
Washington, D.C. 20201
Tel: 202, 245-0843

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Interests: Research, development and evaluation of new technology leading to the solution of problems of housing, urban development and mass transportation.

Address: Assistant Secretary for Research and Technology
Department of Housing and Urban Development
Room 4100, 451 7th St., S.W.
Washington, D.C. 20410
Tel: 202, 755-5600

DEPARTMENT OF THE INTERIOR

Geological Survey

Interests: Fundamental research in topography, geochemistry, hydrology, geology, geophysics, related sciences, and new techniques and methods for appraising and conserving minerals and water.

Address Director, U.S. Dept. of the Interior
Geological Survey
12201 Sunrise Valley Drive
Reston, Va. 22092
Tel: 703, 860-6111

Bureau of Mines

Interests: Basic and applied research in extraction, processing, use, reuse, and disposal of minerals and mineral fuels; recovering and recycling mineral substances from wastes including urban refuse; research in improving mining practices and devising new systems that will reduce health and safety hazards to workers in the metal, nonmetal, and coal producing industries; and environmental quality research and studies associated with problems of surface disturbance, air and water pollution, and waste disposal that are common to the processes used in extracting minerals from the earth.

Address: Director, Bureau of Mines
"C" Street between Eighteenth and Nineteenth Streets
Washington, D.C. 20240
Tel: 202, 183-4815

Office of Water Resources Research

Interests: Encourages and supports research investigations dealing with major problem areas and which hold promise of contributing to the solution of important water problems.

Address. Director, Office of Water Resources Research
6008 Fifth Road, North
Arlington, Va. 22203
Tel: 703, 343-5975

Office of Assistant Secretary - Energy and Minerals Research

Interests: Encourage and support electrical power transmission and distribution research to improve the cost for electrical cables. Work in cooperation with the Electric Power Commission in California.

Address: Assistant Director F.F. Parry
Department of the Interior
Office of Research and Development
18th and E Street, N.W., Room 4452
Washington, D.C. 20240
Tel: 202, 343-8713

National Park Service

Interests: Encourages and supports research dealing with environmental studies, wildlife studies, historical architecture studies, site survey studies, natural history studies, and social history studies. The NPS supports ecological studies dealing with any relationships of a concentrated number of persons affecting ecology, such as visitors, etc.

Address.
Chief Scientist Dr. Theodore W. Sudia
National Park Service
19th & E Streets, N.W.
Washington, D.C. 20240
Tel: 202, 523-5051

Office of Coal Research

Interests. Concerned with the utilization of coal in liquefaction and gasification in research and development.

Address: Office of Coal Research
Department of the Interior
2100 M Street, N.W.
Washington, D.C. 20037
Tel: 202, 343-5533

United States Fish and Wildlife Service

Interests: The Service has no authority to award grants. They do, however, contract with universities and colleges for

research interests. Basic research is conducted and is necessary for the preservation and enhancement of natural resources.

Address: Dr. Eugene Hester, Associate Director
U.S. Fish and Wildlife Service
Department of the Interior
Washington, D.C. 20240
Tel: 202, 343-2279

DEPARTMENT OF JUSTICE

LAW ENFORCEMENT ASSISTANCE ADMINISTRATION

National Institute of Law Enforcement and Criminal Justice

Interests: The NILECJ conducts research programs for the LEAA in seven categories:

(1) Community Crime Prevention - violence, crime victims, environmental design, white collar crime and fencing, etc.

(2) Juvenile Delinquency - juvenile incarceration, employment, and youth crime, etc.

(3) Police - police patrol, police integrity and professional responsibility, police administration, forensic science, personnel utilization.

(4) Courts - performance measures for courts, sentencing, court administration, diversion.

(5) Correction - a) reconceptualization toward working for new methods of rehabilitation; b) accessment of adult correction; c) offender classification.

(6) Advanced Technology Division - Deals with hardware - police armor, body equipment, police vehicles, closed-circuit television ballistic shields, etc.

(7) Education and Manpower
a) - Education Programs under LEAA
b) - Visiting Fellows Programs
c) - Manpower Surveys

Address Director of Research Programs
National Institute of Law Enforcement and Criminal Justice
LEAA
633 Indiana Avenue, N.W.
Washington, D.C. 20530
Tel: 202, 386-4451

DEPARTMENT OF LABOR

Office of Administrative Services - Office of the Assistant Secretary

Interests: The Office of Administrative Services directs and controls all of the following Department of Labor facilities and services relating to procurement.

Address: See below

Bureau of Labor Statistics

Interests: Conducts a program of statistical surveys and economic analyses on labor-related issues including manpower and employment, prices and living conditions, wages and industrial relations, productivity and technological developments, occupational safety and health, structure and growth of the economy, poverty, urban conditions and related socio-economic issues, and international labor comparisons.

Address. See below

Labor - Management Services Administration

Interests: Develops labor-management policy, assists national interest collective bargaining and counsels state and local governments on labor-management relations.

Address. See below

Occupational Safety and Health Administration

Interests: Assists and encourages the states in their efforts to assure safe and healthful working conditions. Provides research, information education and training in the field of occupational safety and health.

Address: See below.

Employment Standards Administration

Interests: Advise and assist the Secretary on all matters related to Employment Standards programs, policies, and systems, and provides executive direction for the Nation's wage-hour, employee's compensation, wage determination, federal contract compliance, programs for women, and all other related programs.

Address:
Office of Administrative Services
Chief, Division of Procurement
Room 7102, Manpower Labor Building
14th and Constitution Avenue, N.W.
Washington, D.C. 20210
Tel: 202, 961-2580

MANPOWER ADMINISTRATION

Office of Policy, Evaluation and Research

Interests: Administers the manpower research and development program and the review and analysis of manpower program performance.

Address: U.S. Department of Labor
Manpower Administration
Director, Office of Manpower, R & D
Room 9100, Patrick Henry Building
Washington, D.C. 20213
Tel: 202, 376-7335

BUREAU OF INTERNATIONAL AFFAIRS.

Interests: Administers the international labor and manpower activities of the Department of Labor.

Address: Bureau of International Affairs
Director, Administration Management Staff
Room 7380, 14th & Constitution Ave., N.W.
Washington, D.C. 20210
Tel: 202, 961-3786

DEPARTMENT OF TRANSPORTATION

OFFICE OF THE SECRETARY FOR UNIVERSITY RESEARCH

Interests: The Office of the Secretary for University Research is the central office of DOT concerned with the procurement of services and studies to universities and colleges relating to the following individual offices:

Office of the Assistant Secretary for Policy and International Affairs

Interests. The procurements for this office include studies and analyses conducted on a broad range of transportation policy, economic and environmental problems to determine the national transportation requirements; and studies aimed at removing the impediments to the efficient flow of passengers and cargo.

Office of the Assistant Secretary for Environment and Urban Systems

Interests: The procurements for this office include transportation policy studies relating to the environment and urban systems and includes research to minimize the environmental and urban impact of transportation, improve the intermodal urban and regional transportation planning process, and coordinate and strengthen transportation policy effecting the environmental and urban systems.

Office of the Assistant Secretary for Systems Development and Technology

Interests: The procurements for this office include analytical studies to support establishment of R & D goals, objectives, policies, plan and information systems; and R & D studies and hardware related to noise abatement, pollution, telecommunications and advanced multi modal programs.

Office of the Assistant Secretary for Safety and Consumer Affairs

Interests: The procurements for this office include a broad range of services and items relating to programs concerning pipeline safety transportation of hazardous materials, safety program coordination, transportation security and consumer affairs.

Any information concerning procurement carried on within the Office of the Secretary of Transportation may be obtained by contacting the following central office

Address Director
Office of University Research
Office of the Secretary
U.S. Department of Transportation
Washington, D.C. 20590
Tel: 202, 426-0190

FEDERAL AVIATION ADMINISTRATION

Systems Research and Development Service

Interests: Design for the National Airspace System and research and development activities associated with programs pertaining to air traffic control, air navigation, communications, airports, aviation weather, aeronautics (airframe structures and materials, aircraft flight systems, propulsion) and in aircraft engineering and safety, including airborne devices, equipment, and systems other than navigation and communications. Special emphasis is placed on the development of simplified, low cost, functional general aviation cockpit instrumentation and control systems. Also conducts close liaison with the Department of Defense on the development of V/STOL and other subsonic aircraft for application to civil requirements.

Address. Director, Systems Research and Development Service
Federal Aviation Administration
Washington, D.C. 20590
Tel: 202, 426-3577

National Aviation Facilities Experimental Center

Interests: Conducts all research, experimentation, testing and evaluation of aviation research and development programs under the direction of the Systems Research and Development Service.

Address. Manager, National Aviation Facilities Experimental Center
Atlantic City, New Jersey 08405
Tel: 609, 641-8200

Office of Aviation Medicine

Interests. Conducts a medical research program that deals in clinical medicine and human factors. The program is directed toward the solution of current and anticipated problems in the medical aspects of aviation.

Address. Federal Air Surgeon
Office of Aviation Medicine
Federal Aviation Administration
Washington, D.C. 20590
Tel: 202, 426-8326

FEDERAL RAILROAD ADMINISTRATION

Interests: Research and development in railroad and high speed ground transportation, including but not limited to aerodynamics, vehicle control, communications, and guideways. It also contracts for demonstrations to determine contributions that high speed ground transportation could make to effect an efficient and economical intercity transportation system, and surveys to measure public response to changes in service.

Address:
Chief, Contracts and Procurement Division
Federal Railroad Administration
Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590
Tel: 202, 426-0872

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Interests. The National Highway Traffic Safety Administration is responsible for programs to reduce deaths, injuries, and property damage resulting from traffic accidents. It is also responsible for the establishment and enforcement of safety performance standards for motor vehicles and associated equipment; the effectuation of supporting research, including the acquisition of required testing facilities; and the administration of the National Driver Register. The Administration further provides for a coordinated national highway safety grant program to be carried out on a matching fund basis with the States, and authorizes supporting highway safety research, development, and demonstration programs.

The NHTSA enters into contracts with private industry, educational institutions, non-profit organizations, and State and local governments for defects investigations, crashworthiness programs, system operations, emergency medical services demonstration projects, safety manpower development, driver/vehicle interaction, experimental safety vehicles, test and evaluation, vehicle structures, occupant packaging, biomechanics, passive restraint tests, computer support, management studies, and data acquisition.

Address: National Highway Traffic Safety Administration
Office of Contracts and Procurement
(Code 48-30)
400 Seventh Street, S.W.
Washington, D.C. 20590
Tel: 202, 426-0607

URBAN MASS TRANSPORTATION ADMINISTRATION

Interests. The Urban Mass Transportation Administration (UMTA) is responsible for the conduct of a program to assist in the development of improved mass transportation through financial aid to State and local governments and their instrumentalities, and research and development. Principal procurement activities are centered around the UMTA Office of Research Development and Demonstration. Research contracts may be for either hardware (such as the development of improved managerial procedures in the areas of maintenance, routing, scheduling, accounting and reporting.)

Address: Mr. Philip Hughes
Urban Mass Transportation Administration
2100 Second Street, S.W.
Washington, D.C. 20590
Tel: 202, 426-0090

U.S. COAST GUARD

Environmental Transportation and Technology Division

Interests Conducts the full range of R & D activities within two main branches: (1) pollution - sewage and waste water treatment, remote detection of oil and other such hazards, (2) aids to navigation - light power sources, warning systems for buoys, and other basic ocean engineering systems.

Address Chief Commandant (G-det-62)
Office of Research and Development
United States Coast Guard
400 Seventh Street, S.W.
Washington, D.C. 20590
Tel: 202, 426-1042

Marine Safety Technology Division

Interests: Conducts research in two main areas: (1) rescue and search projects in helicopter operations, detection of people in water, communications, satellite communications, domestic ice-breaking, and high performance watercraft; (2) research in commercial visual safety projects in fire and explosion safety, research to minimize collisions, investigation of structural problems, survival problems, and crew safety problems.

Address:
Chief Commandant (G-det-62)
Office of Research and Development
U.S. Coast Guard
400 Seventh Street, S.W.
Washington, D.C. 20590
Tel: 202, 426-1008

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Headquarters Contracts Division

Interests: The Headquarters Contracts Division of the Headquarters Administration Office is responsible for planning, negotiating, awarding, and administering contracts based on procurement requirements initiated by the Headquarters Office. Such requirements include, but are not limited to: system engineering services, reliability studies, initial phases of research and development projects, recruitment advertising services, mobile lecture-demonstration units, exhibits, motion services, management analysis surveys, and various professional services. In addition, the Division has agency-wide responsibility for negotiation and execution of NASA contracts with foreign governments and foreign commercial organizations.

Research and Development contracting is the most important phase of National Aeronautics and Space Administration operations, accounting for more than two dollars out of every three in current budgets. Research and development funds are divided into major programs and projects such as launch vehicle and propulsion programs with a goal of greater simplicity, reliability, and payload capability; the manned space flight program, geophysics and astronomy programs for the gathering of greater and more accurate knowledge in these fields; applications programs for the perfection of communication systems and a host of other projects covering the many problems involved in aerospace/medicine, bioscience, nuclear systems, lunar, and planetary programs.

Most NASA business flows to contractors directly from NASA installations outside Washington, since most general procurement and much research and development contracting is decentralized for maximum efficiency in technical control. These installations are: Ames Research Center Flight Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, John F. Kennedy Space Center, Langley Research Center, Lewis Research Center, Manned Spacecraft Center, Marshall Space Flight Center, NASA Pasadena Office, Space Nuclear Systems Office, Wallops Station.

Address Procurement Officer
National Aeronautics and Space Administration
Headquarters Contracts Division
Washington, D.C. 20546
Tel. 202, 755-3394

NATIONAL SCIENCE FOUNDATION

Interests: Sponsors scientific research, encouraging and supporting improvements in science education, and fostering scientific information exchange. The Foundation also provides support for the development and operation of national research centers established to meet national needs for research in specific areas of science. Unlike many federally sponsored research laboratories, the Foundation-supported national research centers do not perform specific research tasks assigned by or for the direct benefit of the Government. They are established and supported for the purpose of making available to all qualified scientists the facilities, equipment, skilled personnel support, and other resources required for the performance of independent research of the scientist's own choosing in the applicable areas of science.

Address National Science Foundation
Contracts Branch, Grants & Contracts Office
Room 630, 1800 G Street, N.W.
Washington, D.C. 20550
Tel: 202, 632-5772

The Foundation supports four astronomy centers (National Astronomy and Ionosphere Center at Arecibo, Puerto Rico; Cerro Tololo Inter-American Observatory located near Santiago, Chile; Kitt Peak National Observatory at Tucson, Arizona; and National Radio Astronomy Observatory at Green Bank, West Virginia) and one atmospheric research center (National Center for Atmospheric Research at Boulder, Colorado). Summary information about the programs of the Foundation (including the National Centers), eligibility requirements, and the address from which more detailed information, brochures, or application forms may be obtained is contained in the National Science Foundation publication *"Guide to Programs"* which is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 3800-0107-Price 75 Cents).

SMITHSONIAN INSTITUTION

The Institution offers two programs which contract for research and development with colleges and universities:

Office of Museum Programs

Interests: Research projects are directed toward the museum as a profession, not as a public endeavor. Therefore projects must focus on improving profession museum practices, technology, and manpower training.

Address: Frederick Schmid
Office of Museum Programs, Smithsonian Institution
Washington, D.C. 20560
Tel: 202, 381-6581

Office of International Activities
Special Foreign Currency Program

Interests: Contracting currently includes the fields of archeology, biology, botany, and anthropology. Countries currently included in the program are India, Arab Republic of Egypt, Tunisia, Poland, Burma, Guinea, and Pakistan.

Address: Kennedy B. Schmeltz
Office of International Activities
Special Foreign Currency Program
Smithsonian Institution
Washington, D.C. 20560
Tel: 202, 381-5881

UNITED STATES INFORMATION AGENCY

Interests: USIA provides for the dissemination of information about the United States, its people, culture, and policies by promoting a better understanding of the United States in other countries. Means used to accomplish this purpose are through radio broadcasting, motion pictures, television, exhibits, personal contact, lectures and seminars, information centers, libraries, English language instruction, press placement, magazines and other publications, book translation and distribution, and providing facilitative assistance to foreign press and television journalists covering public affairs and developments in the United States.

Survey type research of information is covered in these major areas: (1) Program Evaluation evaluation of agency programs, and media activities such as Voice of America and others, (2) Foreign Opinion - questioning of United States foreign policy; (3) Miscellaneous - documentaries and academic research on foreign relations, problems in societies, and other similar topics.

Address: United States Information Agency
Office of Research
1750 Pennsylvania Avenue, N.W.
Washington, D.C. 20547
Tel: 202, 632-6662

III. GLOSSARY OF TERMS

Bidder's List	A file of qualifying organizations maintained by federal agencies and departments for the purpose of notifying such organizations of invitations to bid on a federal contract. Organizations may be included on the bidder's list by completing Standard Form 129 (See Appendix A) and submitting it to the appropriate federal agencies and departments. The Department of Defense may require applicants to complete a supplemental form DOD Form 558-1 (Appendix A). Organizations on the bidder's list may be notified of an RFP in advance of public notice.
Commerce Business Daily (CBD)	The publication of the Department of Commerce which announces the availability of contracts (RFP) and recipients of contract awards for the federal government. The *CBD* also publishes occasional information of interest to organizations engaged in business with the federal government. Subscriptions to the *CBD* may be ordered from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20420, currently at $63.50 a year.
Contract	The legal agreement between the federal government and organizations eligible to receive federal funds by which the government acquires goods, services (research and development), property or systems of direct benefit or use by the federal government. A contract procures for the federal government a definable product or service for a negotiated price and/or work schedule.
Cost-Reimbursable Contract	The type of contract between the federal government and eligible organizations in which goods or services are provided according to a negotiated work schedule for which cost rates have been predetermined.
Fixed-Price Contract	A type of contract between the federal government and an organization eligible to receive federal funds, in which the goods or services are promised by the organization for a predetermined cost.

Cost-Overrun	The difference between an original estimate and the cumulative total of a cost-reimbursable contract.
DOD Form 558-1	The supplemental form which may be required by the Department of Defense to be completed by an organization applying to an agency or department within DOD to be included on the bidder's list. Standard Form 129 must also be completed by the applicant (See Appendix A).
Federal Assistance	(Definition pending legislation S 2510) The provision of money, services, or property to a state, political subdivision, or person for the purpose of supporting, stimulating, strengthening, subsidizing, or otherwise promoting non-federal activities benefiting a state, political subdivision, or the public generally.
Grant	The legal agreement between the federal government and an individual or a non-profit organization eligible to receive federal funds, in which the federal government transfers money, property, services or other items of value to the grant recipient in support of an activity authorized by federal statute. Proposed legislation (S 3514) would add two provisions to the definition: that a grant would be used to support an activity "to accomplish a public purpose" and that "no substantial involvement" by the federal government would be anticipated in the activity.
Procurement	A comprehensive process by which the federal government dispenses funds, the end product of which is a contract for goods, services (research and development), facilities, or systems. The Federal Commission on Government Procurement would add to the definition that procurement may be in the form of a grant when the federal government obtains rights to information, data, inventions, or obtains performance of work or services or property, even though the primary objective is not to obtain an end product for government use.

RFP (Request for Proposal)	The formal and public advertisement by the federal government of an intention to procure particular goods or services through open competition. RFPs are often referred to as "invitations to bid" on a federal contract. The federal government is required by law to publish all RFP announcements in the *Commerce Business Daily*.
R & D (Research and Development)	An innovative process of scientific and technological preparation for change. Federal agencie and departments sponsor R & D activities to fulfill national objectives.
Standard Form 129	Standard application form to be completed by an organization in order to be included on th Bidder's List for a particular federal agency or department (See Appendix A). Standard Form 129 identifies the applicant's research interests and qualifications.
Unsolicited Proposal	An application to a federal agency or departm for support of a proposal initiated by the app cant. Unsolicited proposals must relate to the research and development interests of the fede agency or department.

IV. INDEX OF AGENCIES AND DEPARTMENTS WITH FEDERAL CIVILIAN AND MILITARY RESEARCH AND DEVELOPMENT ACTIVITIES

STANDARD FORM 129 JANUARY 1966 EDITION FPR (41 CFR) 1 16 802	**BIDDER'S MAILING LIST APPLICATION**	☐ INITIAL APPLICATION ☐ REVISION

Fill in all spaces Insert "NA" in blocks not applicable. Type or print all entries. See reverse for instructions

TO *(Enter name and address of Federal agency to which form is submitted. Include ZIP code)*

DATE

1 APPLICANT'S NAME AND ADDRESS *(Include county and ZIP code)*

2. ADDRESS *(Include county and ZIP code)* TO WHICH SOLICITATIONS ARE TO BE MAILED *(If different from item 1)*

3. TYPE OF ORGANIZATION *(Check one)*

☐ INDIVIDUAL ☐ PARTNERSHIP ☐ NON PROFIT ORGANIZATION

☐ CORPORATION, INCORPORATED UNDER THE LAWS OF THE STATE OF

4. HOW LONG IN PRESENT BUSINESS

5. NAMES OF OFFICERS, OWNERS, OR PARTNERS

PRESIDENT	VICE PRESIDENT	SECRETARY
TREASURER	OWNERS OR PARTNERS	

6. AFFILIATES OF APPLICANT *(Names, locations, and nature of affiliation. See definition on reverse)*

7. PERSONS AUTHORIZED TO SIGN BIDS, OFFERS, AND CONTRACTS IN YOUR NAME *(Indicate if agent)*

NAME	OFFICIAL CAPACITY	TEL NO. *(Incl area code)*

8. IDENTIFY EQUIPMENT, SUPPLIES, MATERIALS, AND/OR SERVICES ON WHICH YOU DESIRE TO BID *(See attached Federal agency's supplemental listing and instructions, if any)*

9. TYPE OF BUSINESS *(See definitions on reverse)*

☐ MANUFACTURER OR PRODUCER	☐ REGULAR DEALER *(Type 1)*	☐ REGULAR DEALER *(Type 2)*
☐ SERVICE ESTABLISHMENT	☐ CONSTRUCTION CONCERN*	☐ RESEARCH AND DEVELOPMENT FIRM

☐ SURPLUS DEALER *(Check this box if you are also a dealer in surplus goods)*

10 SIZE OF BUSINESS *(See definitions on reverse)*

☐ SMALL BUSINESS CONCERN* ☐ OTHER THAN SMALL BUSINESS CONCERN

*If you are a small business concern, fill in (a) and (b)	(a) AVERAGE NUMBER OF EMPLOYEES *(Including affiliates)* FOR FOUR PRECEDING CALENDAR QUARTERS	(b) AVERAGE ANNUAL SALES OR RECEIPTS FOR PRECEDING THREE FISCAL YEARS

11. FLOOR SPACE *(Square feet)*

MANUFACTURING	WAREHOUSE

12. NET WORTH

DATE	AMOUNT

13. SECURITY CLEARANCE *(If applicable, check highest clearance authorized)*

FOR	TOP SECRET	SECRET	CONFIDENTIAL	NAMES OF AGENCIES WHICH GRANTED SECURITY CLEARANCES *(Include dates)*
KEY PERSONNEL				
PLANT ONLY				

THIS SPACE FOR USE BY THE GOVERNMENT	**CERTIFICATION**
	I CERTIFY THAT INFORMATION SUPPLIED HEREIN *(Including all pages attached)* IS CORRECT AND THAT NEITHER THE APPLICANT NOR ANY PERSON *(Or concern)* IN ANY CONNECTION WITH THE APPLICANT AS A PRINCIPAL OR OFFICER, SO FAR AS IS KNOWN, IS NOW DEBARRED OR OTHERWISE DECLARED INELIGIBLE BY ANY AGENCY OF THE FEDERAL GOVERNMENT FROM BIDDING FOR FURNISHING MATERIALS, SUPPLIES OR SERVICES TO THE GOVERNMENT OR ANY AGENCY THEREOF. SIGNATURE NAME AND TITLE OF PERSON AUTHORIZED TO SIGN *(Type or print)*

129.104

INFORMATION AND INSTRUCTIONS

Persons or concerns wishing to be added to a particular agency's bidder's mailing list for supplies or services shall file this properly completed and certified Bidder's Mailing List Application, together with such other lists as may be attached to the application form, with each procurement office of the Federal agency with which they desire to do business. If a Federal agency has attached a supplemental Commodity List with instructions, complete the application as instructed. Otherwise, identify in Item 8 the equipment, supplies, and/or services on which you desire to bid. *The application shall be submitted and signed by the principal as distinguished from an agent, however constituted.*

After placement on the bidder's mailing list of an agency, a supplier's failure to respond (*submission of bid, or notice in writing, that you are unable to bid on that particular transaction but wish to remain on the active bidder's mailing list for that particular item*) to Invitations for Bids will be understood by the agency to indicate lack of interest and concurrence in the removal of the supplier's name from the purchasing activity's bidder's mailing list for the items concerned.

TYPE OF BUSINESS DEFINITIONS
(See Item No. 9)

A. MANUFACTURER OR PRODUCER means a person (or concern) owning, operating, or maintaining a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment of the general character of those listed in Item No. 8, or in the Federal Agency's supplemental Commodity List, if attached.

B. REGULAR DEALER (Type I) means a person (or concern) who owns operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles, or equipment of the general character listed in Item No. 8 or in the Federal Agency's supplemental Commodity List, if attached, are bought, kept in stock, and sold to the public in the usual course of business.

C. REGULAR DEALER (Type 2) In the case of supplies of particular kinds (*at present, petroleum, lumber and timber products, machine tools, raw cotton, green coffee, hay, grain, feed, or straw, agricultural liming materials, tea, raw or unmanufactured cotton linters*). "REGULAR DEALER" means a person (or concern) satisfying the requirements of the regulations (Code of Federal Regulations, Title 41, 50–201.101(b)) as amended from time to time, prescribed by the Secretary of Labor under the \ h-Healey Public Contracts Act (Title 41 U.S Code 35–45). For coal dealers, see Code of Federal Regulation. Title 41, 50–201.604(a).

D. SERVICE ESTABLISHMENT means a concern (or person) which owns, operates, or maintains any type of business which is principally engaged in the furnishing of nonpersonal services, such as (*but not limited to*) repairing, cleaning, redecorating, or rental of personal property, including the furnishing of necessary repair parts or other supplies as part of the services performed.

E. CONSTRUCTION CONCERN means a concern (or person) engaged in construction, alteration or repair (including dredging, excavating, and painting) of buildings, structures or other real property.

DEFINITIONS RELATING TO SIZE OF BUSINESS

A. SMALL BUSINESS CONCERN. A small business concern for the purpose of Government procurement is a concern, including its affiliates, which is independently owned and operated, is not dominant in the field of operation in which it is bidding on Government contracts and can further qualify under the criteria concerning number of employees, average annual receipts, or other criteria, as prescribed by the Small Business Administration (See Code of Federal Regulations, Title 13, Part 121, as amended, which contains detailed industry definitions and related procedures.)

B. AFFILIATES. Business concerns are affiliates of each other when either directly or indirectly (i) one concern controls or has the power to control the other, or (ii) a third party controls or has the power to control both In determining whether concerns are independently owned and operated and whether or not affiliation exists, consideration is given to all appropriate factors including common ownership, common management, and contractual relat onship (See Items Nos. 6 and 10.)

C. NUMBER OF EMPLOYEES. In connection with the determination of small business status, "number of employees" means the average employment of any concern, including the employees of its domestic and foreign affiliates, based on the number of persons employed on a full-time, part-time, temporary, or any other basis during the pay period ending nearest the last day of the third month in each calendar quarter for the preceding four quarters If a concern has not been in existence for four full calendar quarters, "number of employees" means the average employment of such concern and its affiliates during the period such concern has been in existence based on the number of persons employed during the pay period ending nearest the last day of each month. (See Item No. 10.)

COMMERCE BUSINESS DAILY

The Commerce Business Daily, published by the Department of Commerce, contains information concerning proposed procurements, sales, and contract awards. For further information concerning this publication, contact your local Commerce Field Office.

★ U S. GOVERNMENT PRINTING OFFICE 1966 O—214-154

BIDDER'S MAILING LIST APPLICATION SUPPLEMENT

Form Approved
Budget Bureau No 22-R091 6

IF ADDITIONAL SPACE IS REQUIRED, ATTACH SEPARATE SHEET AND REFER TO ITEM NUMBER

1 NUMBER OF EMPLOYEES	OPERATIONS AT	ENGINEERING	PRODUCTION	OTHERS	TOTAL
	MAXIMUM LEVEL				
	MINIMUM *(During last 2 yrs.)*				
	PRESENT LEVEL				

2 CONTRACTS HELD WITH ARMED SERVICES DURING PAST 3 YEARS *(List seperately)*

CONTRACT NUMBER	DESCRIPTION OF ITEMS	DOLLAR VALUE

3 TYPES OF EQUIPMENT, COMPONENTS, MATERIAL OR SERVICES NOW BEING MANUFACTURED, PERFORMED, OR DEVELOPED *(Commercial and Military)*

4 FLOOR SPACE *(Sq ft)*	ENGINEERING	LABORATORY	TOTAL FLOOR SPACE *(Including warehouse and manufacturing space)*

5 BRIEF DESCRIPTION OF BUILDINGS *(Type of construction and use)*

6 MACHINERY AND EQUIPMENT[1]

7 TESTING AND/OR LABORATORY FACILITIES[1]

8 ADDRESSES *(Including counties)* OF FACTORIES, FOUNDRIES, MINES, OR YARDS IF ANY *(Specify)*

9 SECURITY CLEARANCE *(If applicable, check highest clearance authorized by clearing agency)*

FOR KEY PERSONNEL				FOR PLANT ONLY			
☐	TOP SECRET	☐	CONFIDENTIAL	☐	SECRET	☐	CONFIDENTIAL
☐	SECRET						

LIST DEPARTMENTS WHICH HAVE GRANTED SECURITY CLEARANCE AND DATES GRANTED

10 INCLOSURES *(Check)* ☐ FINANCIAL STATEMENTS, INCLUDING OPERATING STATEMENTS ☐ DESCRIPTIVE LITERATURE ☐ ADDITIONAL INFORMATION ATTACHED ☐ BROCHURE ☐ CATALOG ☐ PHOTOGRAPHS

11 I CERTIFY THAT THE INFORMATION SUPPLIED HEREIN *(Including any attachments)* IS CORRECT

DATE	NAME AND ADDRESS OF APPLICANT	SIGNATURE

[1] *Give brief, representative outline of type and condition of machinery, equipment (6), and facilities (7) available, if not owned by firm, give status in detail*

DD FORM 1 AUG 50 558-1 EDITION OF 1 JAN 54 IS OBSOLETE

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Marina del Rey, California

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Computer Users Society of America

Objectives: Assist constituent societies

Develop educational programs

Encourage involvement with professional and societal groups and government agencies

Publications and meetings

STRUCTURE AND PURPOSE

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ADDRESS: 3401 Market Street
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215-349-8495

PURPOSE: Research, publication, education

Seminars, meetings, workshops, committees

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K U R Z W E I L R E A D I N G M A C H I N E

A two-foot cube with a glass-top scanning device that reads printed pages aloud, e.g. to the blind, has been described in the newspapers. Developed by "a Cambridge, Massachusetts research firm" (name and address unknown to AJCL), the machine is described as capable of reading almost any printed type from newspapers, magazines, etc.

It is said to be able to recognize hundreds of different type faces and to determine the correct pronunciation of English words. However, its intonation is said to be flat, and its pronunciation of some words "bizarre"

The machine is to be available for institutional use in a year or two, and for homes in four or five years. The price is predicted to start initially at $25K, falling eventually to a fifth as much.

EDITOR'S NOTE: Any reader with further information to contribute is invited to write to AJCL.

LA JOLLA FIRM

Translating Machine Developed

By JAMES CARY
Washington Bureau Chief, Copley News Service

WASHINGTON — Have you ever heard of a machine that can translate Russian, Chinese, German and French into English?

A machine that can analyze thousands of words of a foreign language text and prepare summaries and analyses in English?

A machine that has stored vocabularies that permit it to translate foreign language material dealing with such scientific disciplines as chemistry, physics, electronics, aviation, metallurgy, earth sciences and mathematics?

It exists and has been in use by the U S Air Force since 1970. It also was used by the National Aeronautics and Space Administration during the recent combined U.S.-Soviet space flight.

Actually, however, it is much more than a machine. It is a system developed by Dr Peter Paul Toma of La Jolla, who has been working since 1956 to combine the capabilities of computers with the science of linguistics

His system is known as "Systran," an acronym formed from the words system and translation, or what he calls the world's first fully automated universal machine translation system.

Sold By La Jolla Firm

It is now being marketed in the United States and Europe by Latsec, Inc , Toma's La Jolla-based firm that takes its name, again an acronym, from "language translation systems and electronic communications."

Toma says Systran is being used by the European Common Market, and is in various stages of use in Luxembourg, Germany and Canada, in addition to the United States

The chances of it spreading are quite good Toma demonstrated the system here Monday before a two-day seminar sponsored by the Foreign Broadcasting Information Service, the government agency that monitors and provides translations of all major foreign broadcasts

Russian language texts were punched, letter by letter, on what is called a Carterfone S-15 C — a form of electric typewriter. This was transmitted by telephone to the Teledyne Ryan computer in San Diego, which had been programmed to receive it, and then — after some problems were worked out — was sent back by the computer in English.

As Toma explains it, this can be accomplished with any relatively advanced computer, after it has been programmed to operate as a translator.

Fed Into Memory Bank

The system is recorded on magnetic tapes or discs which are fed into the computer's memory bank, giving it a vocabulary to operate within whatever language is to be used

At this time, it is possible to program a computer to translate from Russian to English, English to Russian, German to English, Chinese to English, French to English and English to French

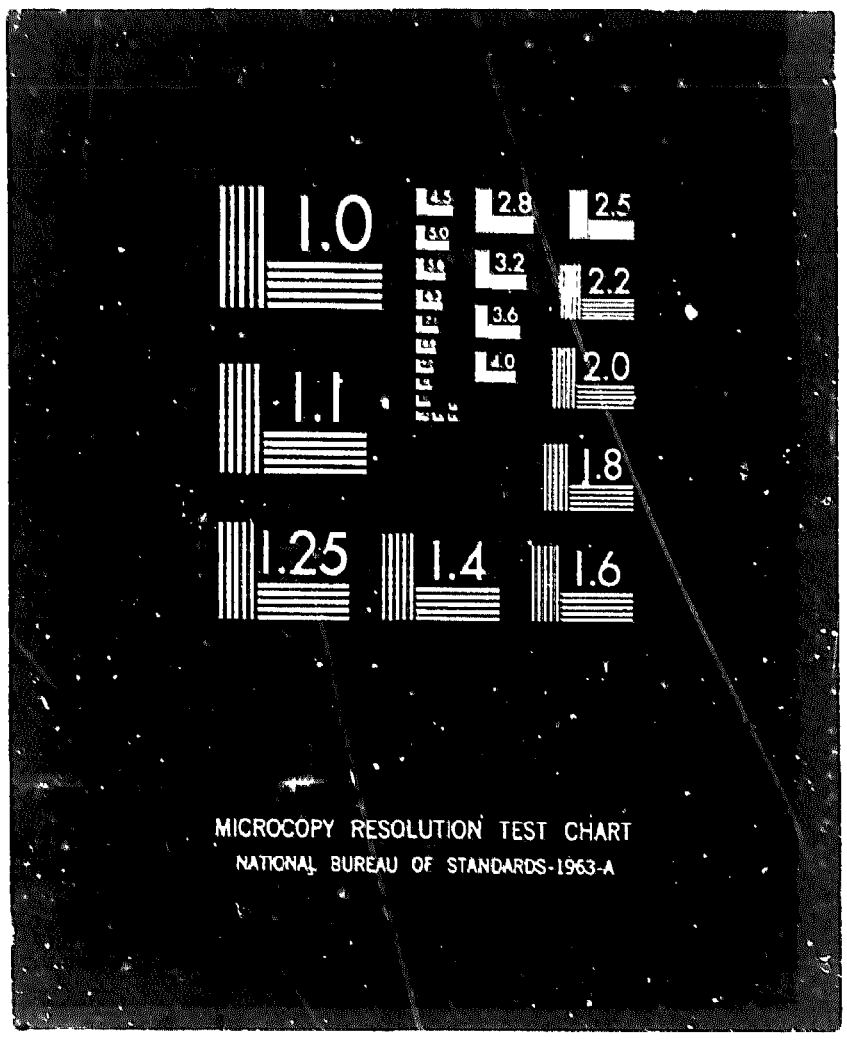
It also is possible for the computer to receive up to three foreign language transmissions simultaneously, record them and then translate them separately, normally within an hour.

There is no claim that the translations are literarily perfect. But they are what is called "usable translations," and they can be obtained quite rapidly.

Latsec says the system can be used to provide what is called content analysis, or automatic abstracting and political trend prediction. In other words, it can be used to analyze a text and select common themes in many texts to indicate trends.

FROM THE SAN DIEGO SUN, 11 MARCH 1976

END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