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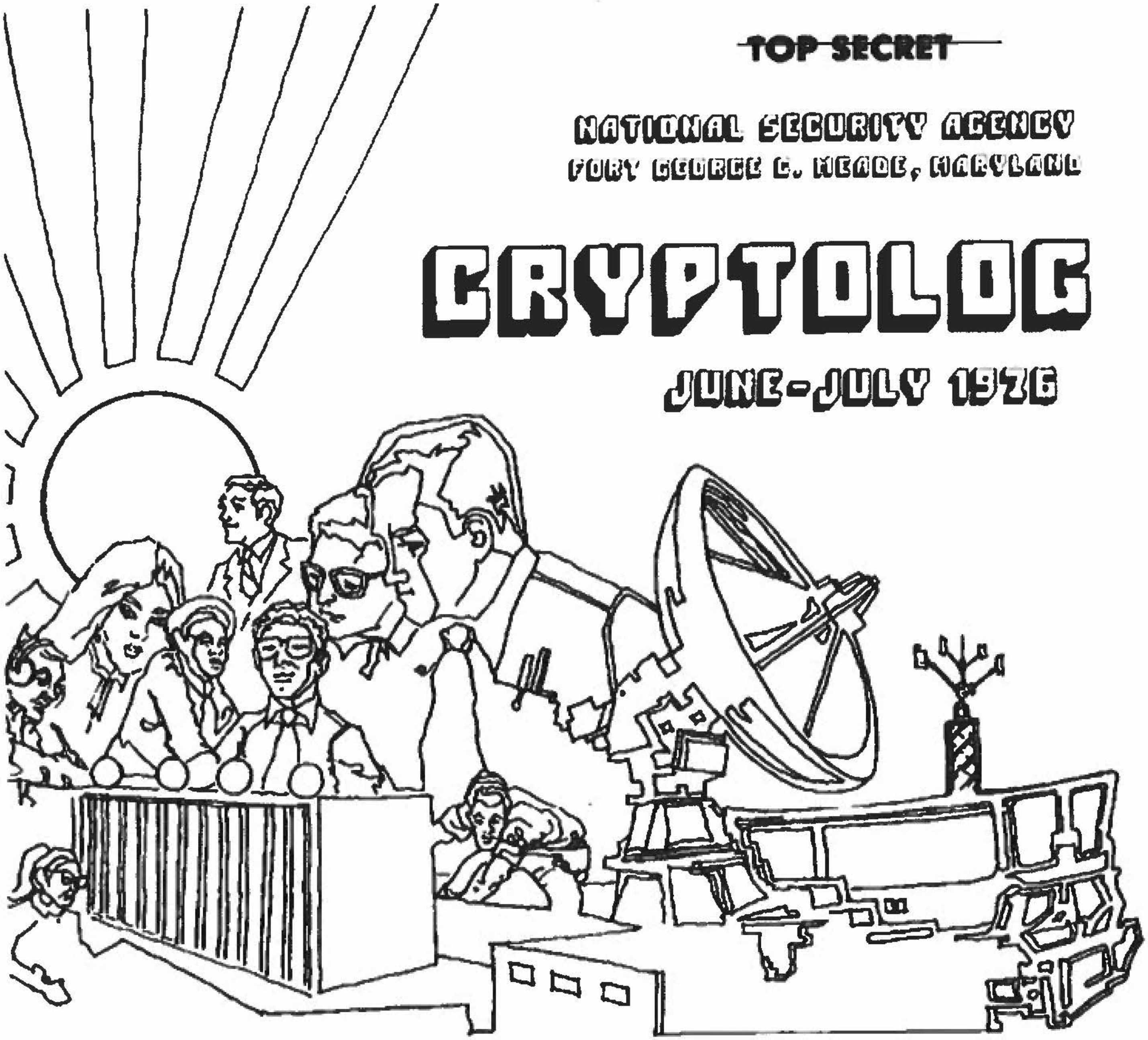

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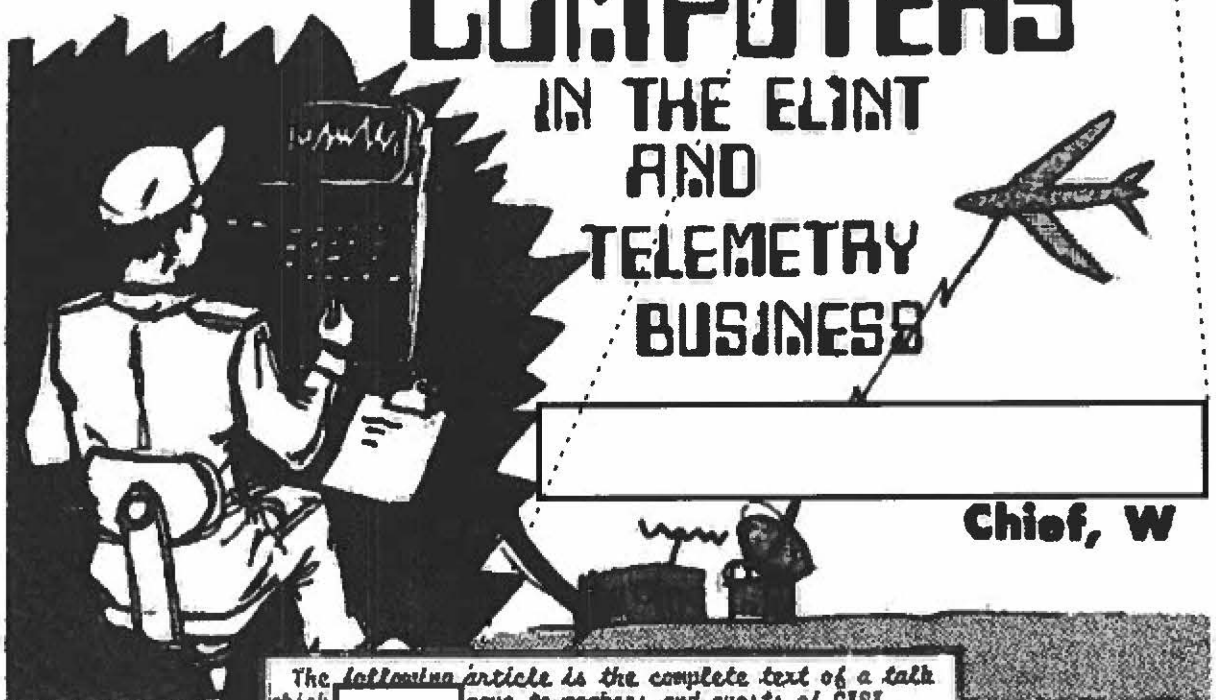
COMPUTERS IN THE ELINT AND TELEMETRY BUSINESS



[redacted]

Chief, W

The following article is the complete text of a talk which [redacted] *gave to members and guests of CISI (NSA Computer and Information Sciences Institute) in the Friedman Auditorium on 22 January 1976.*

In order for you to calibrate what I have to say, I want to make it very clear that I am not a computer expert. I have never participated in the design of any computers, I have had little operational experience with the care and feeding of them, and I have never written software. But I have had the opportunity to help design and work with a number of systems that use computers in very important ways, and I am in a position now to affect the market for computers in the ELINT and telemetry business. I'll be directing my remarks at *uses*, not computers themselves.

When you don't intend to say anything very profound (or may be afraid that you won't, although it is all that you know), you often call your talk or book an "Introduction to. . .". I've resisted that today, just to lure more of you here. But it was suggested to me that a brief introduction to ELINT and telemetry might be in order. I'll start with that and keep it *very* basic. Then I'll phase into the description of a current set of computer applications, and end with what I see as real trends in this area.

Introduction to ELINT and Telemetry

To most people, ELINT really means all those things that go on to exploit the transmissions of enemy radars. That used to be real simple. Then staffs got too large here and there and we had several types of ELINT: some Technical ELINT, some Operational ELINT, some Electronic Warfare, some Electronic Support Measures, and to some, everything that isn't COMINT. I actually can explain all that, but it would take too long and it isn't really very important except that it does contribute to some of the confusion. The ELINT I'm going to talk about today is mostly good for two things:

[redacted]

These two things are, themselves, interactive.

This kind of ELINT is concerned with the determination of the capability of the radar system. It is built on a signals-analysis, or measurement capability. Today it is usually called Technical ELINT.

But what do you see when you look at a radar? Unfortunately, the transmission from the radar, and usually only that. [redacted]

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[redacted] When we can get at other signals from the system we are usually much better off. While this always looks simple (and in concept it is simple), real life has a way of complicating things. Take, for example, the [redacted] That's too long! We think we can do better now. But, remember, we must assemble data that is likely to be collected over a long period of time, and retain confidence in that data.

When we deal with telemetry, we are usually a little better off. At least someone is intending to transmit information. [redacted]

Our main job is to get that information, demodulate it, order or display it, and examine it in some way which will help the community to decide what was going on and what was important.

Generally speaking, there are fewer areas of confusion in nomenclature surrounding telemetry. However, to some people it is just ELINT. To others it is COMINT. To some, only that stuff [redacted] which is related to the [redacted] sensor data is something else. Other folks like to include things like beacons, certain instrumentation transponders, interferometer signals, and other things into what is called FIS (Foreign Instrumentation Signals). For our purposes here today, it is safe to think of all of that as telemetry.

It is important to understand the magnitude of the target. I hope you all realize that [redacted]

This continues to be a very important source of information. You may be interested in reading what Dr. Tordella had to say about telemetry not very long ago. It's recorded in the *NSA Technical Journal*, Fall 1974 (pp. 5-8), under the title, "Selected SIGINT Intelligence Highlights."

[redacted]

Just remember that ELINT and telemetry are what you must add to COMINT to get SIGINT!

And now, on to computers!

Current Set of Computer Applications

We use -- depend on -- computers in all phases of ELINT and telemetry:

Intelligence
. *Collection*
. *Processing*
. *Analysis*
Operations

Data Storage and Support

I'll give some examples of applications in the intelligence field, but I'll avoid talking about "Data Storage and Support." While such applications are significant, they are not now much different from any other complex filing problem. You should not infer that I'm happy with what goes on in this area. Sometimes I think our only solution would be a big fire! I wish that somebody would find a fundamentally different way to file information. I hope some of you are working that problem. I have no ideas to contribute.

Operations -- military, not SIGINT -- are included in the box above because an interesting coupling exists here. Perhaps it is unique in the intelligence business. We'll touch on that later in this presentation.

Let's look at a very generalized collection operation (Fig. 1). Computers are used much more extensively in the collection phase of our work than is currently the case in COMINT. People have been able to apply digital data-handling [redacted]

[redacted] systems). The generalized scheme that you see here could be almost anything, but I'll claim that it represents an advanced ELINT collection system. You'll note that all parts of the thing (perhaps even the operator) are under computer control.

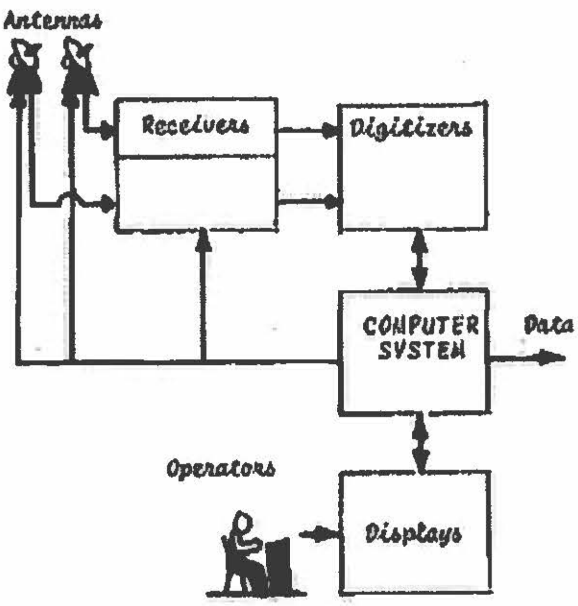

Fig. 1

Let's size one effort, the largest that I know of. The box marked "Computer System" in Fig. 1 is made up of:

[redacted]

I think it is impressive. It has been operating for over three years. The functions of the computer are essential. Put another way, you could not do this intelligence collection job in any other way. It is that simple. The computer makes it possible.

There are other functionally similar systems, both larger and smaller, both in operation and planning stages at this time.

Telemetry Processing

For a look at a good classic processing system, let's move to the telemetry area. Again, I have a very simplified idea of what constitutes a processing system -- almost anything will fit into the block (Fig. 2).

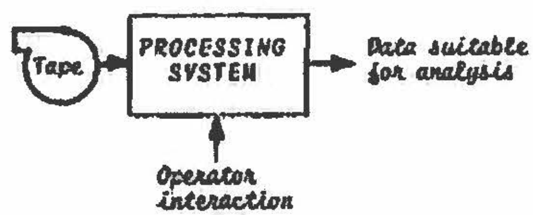

Fig. 2

By my definition, we generally are not working on-line with the data. Some sort of buffering or storage -- presently tape -- is used. What comes out of a processor isn't yet a particularly useful piece of intelligence or even SIGINT. People still need to be involved.

One of our major investments in the telemetry-processing business is a thing called LAMMAN. I could show you a picture of it, but you people who work with computers have a problem: you've seen one, you've seen them all. LAMMAN is built around a single SIGMA-V computer with three disc units and six rapid-access devices (RADs).

The kind of job that it does is probably best described by a look at the input signal. It works (mostly) on a signal which we call

[redacted]

You just must be able to make some order out of all that for any analytic purpose. If you can do that without a computer, we would like very much to have you in W! As a matter of fact, if you're good at doing it *with* a computer, we'd like your help too!

Anyway, LAMMAN does the [redacted]

Don't forget the volume! Several systems of comparable capability exist in the community but not for such [redacted]

Analytic System

My analytic examples are also based on the simple concept shown in Fig. 3. The "analytic system" may be a special combination of hardware and software, or simply software for some nice general-purpose machine. The size varies a lot here: from programmable Hewlett-Packard desk or hand calculators to CDC-7600s.

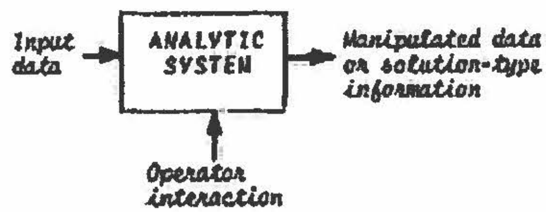

Fig. 3

Let's look at two examples. Our first example is a signal-analytic tool called LOVEDAY. [redacted] The operator has access to dis-

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plays for both quality control and analysis purposes. He has a lot of options available to him. We think that this tool will prove to be very useful in setting up special (perhaps [redacted] We can also try a variety of detection techniques that would be near impossible with hardware.

There is nothing particularly unique about the hardware for LOVEDAY. A lot of attention has been given to making all the parts work well together. The basic hardware, in addition to the [redacted] Having this particular thing as a stand-alone unit is new to us, although we have a number of stand-alone computer-based devices.

[redacted] equations. You have more data or equations than unknowns. The problem usually has something to do with the unknowns being related in some way that isn't obvious -- solutions to the equation sets are not unique. Therefore, you play around with what you believe to be practical constraints on parts of the problem until you get a "unique" answer. Analysts love to argue about the wisdom of the other guy's constraints, as you can imagine! An example may help here. . .

[redacted] two hours of work is about normal for this kind of job.

[redacted]

This program -- and its relatives -- is a powerful analytic tool for us even though it isn't now. Perhaps anything that lasts 12 years or so in this business is serving a real need.

There are several other examples that could be used here. Many of them are in the general area of [redacted] Most of them are either aids to the visualization of some difficult [redacted] We have not yet learned, any more than anyone else, what the key is to really promote useful exchange of information between man and machine. As you can see, many of our problems have a physical-science base and good display techniques can demonstratably help an analyst to sense things like the dynamics of a problem or a particular situation. That may be the key to his understanding of what's going on. We think that more attention, study, thought, and experimentation are merited in this area. For example, we've done some work on color displays as an aid in sorting data. This resulted in some very colorful designs -- good for ties and wall hangings, for sure -- but it isn't clear that it is a particularly helpful thing to do as a general-purpose approach to a problem.

Projections; Trends and Guesswork

I hope that the preceding comments have given you some feel for computer applications at the present time. Now let's look at the future. The "future" in the computer field is hard to see. Computers are still in the growth phase, where technological advances can seriously affect what you can do. While we are sitting here, some Japanese researcher with an unknown name may be putting the finishing touches on a paper which will create a new market. Applications do not move so fast. It is important to note that the ELINT and telemetry business does not drive the industrial market to any appreciable extent. We simply use what is available.

Okay, then, some trends. . .

We will continue an already existing trend toward the preparation of data in the field. Some of this will functionally look exactly like what we now do here. Other parts will tend to smear further the dividing line between processing and analysis systems. There are clearly three things which drive this trend:

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- Continued pressure to reduce overseas manpower causes us to want to automate a variety of functions;
- There is a desire for timely results -- experimental things need to be understood before they are operational; and
- Technology exists to do it -- both in the computer field and in the communications-support field.

Small general-purpose computers will be the heart of these things wherever possible. Some special-purpose microprocessors may be required in the telemetry business, but I personally doubt it, because it won't be easy to prove that they are really economical in the small numbers that we require. [redacted] This will permit us here to concentrate on the material that requires large work factors.

A second trend is that one-of-a-kind things -- such as LOVEDAY -- will exist at single locations, but the analysis jobs may be performed on them by people from other organizations. The analysis problem is distributed, the skills are distributed, but the expensive tools exist mostly at NSA. Part of the solution is a social-science problem: How do you convince everyone that it is okay to do what common sense says? But there is another part: How do we transfer the data around? How do we store it? How do we go about retrieving it from remote locations? We are working now on a limited-access data base which can be available from a few selected locations. This may lead to remote operation of some of the analytic equipment as well. The trade-off is *cost*. Right now, it looks cheaper to send the data around, but time could change that answer.

A very real analytic trend is toward the use of small desk-type machines (maybe even called calculators by some) for jobs which once were performed by large machines. We haven't seen the end of this trend yet. Cost isn't the only factor here. We can make the analyst more efficient if he can choose his tools. I'm sure we can continue to be able to say that "we've got the largest computer complex in the free world here at NSA" -- if that's important.

A real guess -- not yet a trend -- is the automatic analysis of "routine" data. Perhaps this can best be explained by the following [redacted]

Perhaps that's stretching it, but not by much. Meanwhile, our folks are still looking at squiggly lines. We produce those lines with great care, but that's what they are. I think that we can develop computer-based systems that will direct our attention toward only those things that are important. [redacted] of course, but shortly thereafter. This may reflect back into the processing system in a way that will greatly reduce set-up time. It could be that this is a dry well. My analysts are "luke-cool" at best. One of us doesn't understand the problem. I'm anxious to learn who it is.

Electronic Warfare Operations

Now for the promised look at the electronic-warfare operations area which I claim has a large influence on what we do. A couple of generalized examples will show what I mean.

Suppose you are in an advanced aircraft flying in a hostile environment. You can hear all kinds of electronic transmissions, radar, beacons, communications -- you name it. Some of these transmissions represent real threats to both your mission and your life. But which ones? And what can you do about it? Years ago you were lucky if you could just notice that you were being tracked by a surface-to-air missile unit. But the computer has permitted a number of other options to be opened up. Now it is within the realm of possibility to sort out the threat systems from the other transmissions, perhaps identify them to individual site, determine their current threat to you (perhaps by looking automatically at data-signal transmissions along with radars), automatically set your jamming modes, and manage the power requirements for your jammers while in action. Further, you may be able to select your tactical target from this signals environment, and assign your weapons. The weapons themselves may even be guided, in some cases, by information directly obtained from the same signals environment!

Or take another example: Suppose you are in a submarine -- again in a hostile environment. When you put your mast up you are very interested in knowing, quickly and accurately, what is around you. You'll use any sensor inputs you can get, particularly if they are passive -- optics, IR, acoustics, and what we might call ELINT if it wasn't already called Electronic Support Measures. What do we hear? What is it? Is it a threat? Where is it?

Equipments exist now, and others are under development, which search the radio frequency environment for signals, automatically identify them, make detailed measurements, compare these to on-board data bases, and sometimes even tell the captain not only what class of ship is out there, how far away, and moving in what direction, but also what its most likely hull number is! In seconds, and with reasonable confidence. All this is possible because of operational applications of computers and some microprocessors.

This sort of operational trend is well-established today. It has a long way to go, but Electronic Warfare is being recognized (perhaps a bit late) as a major part of modern force-structure. Since the computer-technology people have made this possible -- all sorts of new tactics are now possible -- you have a significantly increased set of options you can use to get at your foe.

But these things only work *if*:

- You really know how the threat works,
- You know soon enough to have the equipment ready when you need it, and
- You can keep it upgraded so that its lifetime is long enough to be practical.

These requirements put real teeth into the technical intelligence business. All those nice computers in the field won't be worth anything if they can't be told what to do. We need to catch things earlier in the development cycle, get crucial measurements, run tests (perhaps some active), in order, first, to determine accurately how things work, and, second, to keep these descriptions current, particularly in conflict situations. All of these things feed back into the collection, processing, and analysis activities which are also built around computers.

It could be that the computer is not a "tool" in the ELINT and Telemetry business. It could be that it is *the* thing which actually determines what we do. We may really work *because* of it, if not *for* it.

Summary

In summary, then, we can say that computers are not just useful -- they're essential! They are here to stay, in a big way in our business. We can't get along without them. And with the trend toward distributed functions and with the big EW operations market, they will certainly be even more important in the future.

Thank you for inviting me to address CISI. Perhaps we can follow this up with another presentation that will take a more in-depth look at some of the individual applications.

[redacted]

[redacted]

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ТРАНСЛИТЕРАЦИЯ ИЛИ КИРИЛЛИЦА?
TRANSLITERATsIYa ILI KIRILLITsA?
TRANSLITERATION OR CYRILLIC?
ТРЭНЗЛИТЕРЭЙШН ОР СИРИЛЛИК?

Джин Таунэнд

DZHIN TAUNEND
(Gene Townend, A65)

To be or not to be? That is the question. Whether 'tis nobler to transliterate or render in the original. . .

That's not quite how the quote goes, but the problem seems to have been around at least as long as Hamlet. I would also venture a guess that we here at NSA have collectively expended considerably more nervous energy on our problem than Hamlet did on his. It seems that every 3 to 5 years the spectre of transliteration raises its ugly head anew, and all the decisions we made in the last skirmish have to be "rediscovered" and "restated" yet another time.

Why this problem refuses to stay solved is difficult to determine. Could I suggest, however, that it is because we have not yet solved it?

Having spent about 10 years (1960-1969) transcribing, analyzing, and reporting Russian [redacted] material and about 4 years (1971-1975) in the computer-processing career field and [redacted] Russian [redacted] material, I am aware -- painfully aware -- that discussions of transliteration tend to get very emotional and highly provincial.

In an attempt to lower the emotional content of this article, let me begin by offering a definition of transliteration and then explaining some concepts and properties of transliteration.

Transliteration, as I will be using the term, refers to transforming textual information from one alphabet to another. The properties of a good transliteration scheme are that the scheme should retain as much information about the original as possible, and that it should be easily learned and used by the persons using the particular scheme. In particular, I will be addressing only Russian-to-English transliteration.

[redacted]

Editor's two-cents' worth

Before letting the author get into the body of his article, the editor feels that it might be advisable to take an explanatory side trip, to make certain that everyone knows exactly what transliteration *is* and what it *isn't*. Well, it isn't translation and it isn't transcription. Let's take the following hypothetical situation. You're Mike. You're on a tour of the Soviet Union. You'd like to meet some Russian girls, but your guide watches your busload like a hawk. Finally, one day, you and another guy (Joe) manage to exchange a few remarks with a cute-looking girl standing in line outside of Lenin's Mausoleum. You don't speak Russian, so Joe helps out. Here are a few of the interchanges.

Girl: **Дай мне поцелуй.**
Mike: What did she say?
Joe: **Дай мне поцелуй.**
Mike: No, I don't mean what did she *say?* I mean, what does it *mean?*
Joe: It means "Gimme a kiss!"

Girl: **Как тебя зовут?**
Joe: She wants to know your name.

Girl: **Меня зовут Тамара.**
Joe: She says her name is Tamara.

Girl: **Как вам нравится Москва?**
Joe: She wants to know how we like Moscow.

Just then the guide shows up and shoos you both back onto the bus.

Mike: See you "Tamara"! -- same time, same place!

On the bus, you write down in your handy-phrases notebook (for a nonlinguist, you have excellent auditory acuity and retentivity):

Diamon' yeah putza Louie.
Kahk tibyah suhvoot?
Minyah suhvoot Tamara.
Kahk vahm nravestsa Muskva?

Joe looks over your shoulder and says, "You're spelling everything all wrong!" He crosses out what you wrote and puts down:

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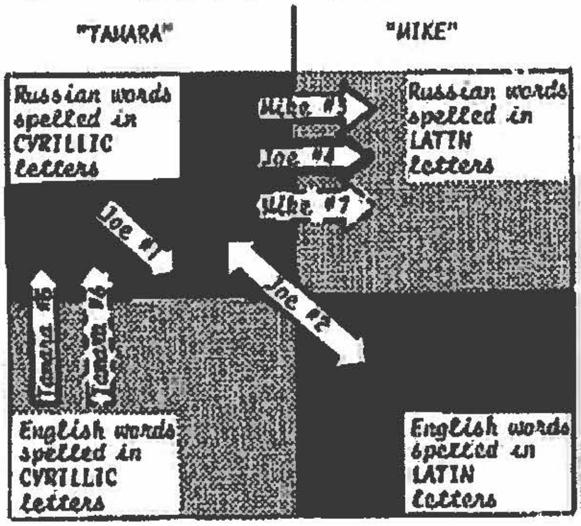
Day mne potseluy.
Kak tebya zovut?
Menya zovut Tamara.
Kak vam nravitsya Moskva?

Meanwhile, back at the Mausoleum, Tamara has jotted down two names in *her* notebook:

Майк, Джо

A lot happened during these brief interchanges, linguistically (if not romantically) speaking. Let's extrapolate everything into a representation of the entire Russian language (left-hand side, "Tamara") and the entire English language (right-hand side, "Mike").



When Mike asked, "What did she say?" and Joe answered, "She said, Дай мне поцелуй" (arrow "Joe #1"), that didn't help Mike much. It was still in Russian! When this process occurs in the COMINT business (that is, listening to people talking in Russian, then putting down on paper, *in Russian*, what they said) it is called TRANSCRIPTION. The process is concerned, sure enough, with what the speaker *said* (his exact words, as he spoke them), but it doesn't help the nonlinguist analyst any. He still doesn't know what it means! (Incidentally, even though this step doesn't yield the English meaning, the voice transcriber has a hard job to do, and he certainly has to *know* what the person is talking about before he can transcribe it.)

What Joe did, after his first little "joke," was to INTERPRET for Mike and Tamara (arrow "Joe #2"). Interpretation is translation, usually back and forth, from one *spoken* language to another. People in the COMINT business rarely are involved in interpretation. Instead, they are usually involved in TRANSLATION (the transformation of text in one *written* language to another written language -- and usually NSA translators specialize in the "into English" direction). Interpretation and translation are concerned with what the utterance *means*. Mike and the NSA nonlinguist don't care a rat's whisker about how the linguist derives the meaning, or how hard it is to master those complicated morphologic and syntactic rules. For example, Joe didn't bother to tell Mike that he changed Tamara's "How does Moscow please itself to you?" to "How do you like Moscow?" or to explain that he "translated" the name of the Russian city from "Moskva" to English "Moscow." As far as the nonlinguist is concerned, it's as easy for the translator to translate as it is for the transcriber to transcribe. So the nonlinguist feels that that should be the end of the problem.

What, then, are those other five arrows doing in the chart? They do not deal with the meanings of the words, but only with their representation in printed form.

When Mike decided, for example, to record the Russian sentences he wanted to remember (arrow "Mike #3"), he did something similar to TRANSCRIPTION ("Joe #1"). But, instead of COMINT-style transcription (writing down on paper the utterance in the original language, as spelled in the original alphabet), he tried to record the Russian sentences in Latin letters on the basis of the Russian *pronunciation*. (This can be done scientifically, but when it's done by amateurs like Mike, it usually looks weird.)

When Joe looked over Mike's shoulder and "corrected" the spelling (arrow "Joe #4"), he was -- we're finally hitting paydirt! -- engaged in TRANSLITERATION. This is what this article, once we get to it, is all about: the spelling of Russian words in Latin letters on the basis of their original Cyrillic *spelling*. The problem is, "Who's got the one true system?" Joe used a system of transliteration in which the Russian letter Й is represented by "y." If he had used the NSA system, he would have written, "*Daj mne poteluj!*" (non-NSAers say that all those "j's" "look funny").

When Tamara wrote the two names in her notebook (arrow "Tamara #5"), she TRANSCRIBED the names into Cyrillic on the basis of their *sound*. She wrote Майк and Джо. She would have been wrong (arrow "Tamara #6") to transliterate them according to their *Latin spelling*: Мике and Йое (that would make them pronounceable in Russian as "Mook-yeah" and "Yoh-yeah"). Ridiculous, isn't it? And yet there are English words in the Russian language which are spelled in Cyrillic and pronounced in Russian in such a ridiculous way.

If Mike were ever to read Tamara's notebook and laboriously transliterate the two names into Latin characters (arrow "Mike #7"), he would obtain "Mayk" ("Majk") and "Dzho." Would he recognize his own name or Joe's? Or would he be completely unaware that he had come up against one of the translator's biggest problems -- the rendition of non-Russian personal names, place names, etc. not by transliteration but by restoring them to their original Latin spellings: not "Nikson," "*Taym* magazine," "Reno," but "Nixon," "TIME magazine," and "Renault."

Transliteration as we will discuss it, then, is a very specific operation: the transformation of Russian text, in Cyrillic characters, into the Latin alphabet according to a specific preferred scheme. The transliteration process does not produce a translation, but carries into the Latin representation all the grammatical information present in the Cyrillic text. Hence the meaning content of the Latin-transliteration text is identical with the meaning content of the original Cyrillic text, and both texts would yield the identical translation.

Several Russian-to-Latin transliteration schemes have been developed. Table 1 shows only a few of them. The list of schemes is not intended to be exhaustive, but, rather, to show the "flavor" of the transliteration world. The various schemes conform, to a greater or lesser degree, to the requirements of accuracy (that is, nonambiguity) and ease of use. Of particular interest is the various handling of the Cyrillic letters

в, е, ж, й, х, ц, ч, ш, щ, ъ, ь, э, ю, я

(14 out of the 33 letters in the Russian alphabet).

Note that:

- except for the manual Morse system, which uses non-letters for certain characters, most schemes use combinations of Latin characters to represent certain Cyrillic characters (that is, the Cyrillic and Latin characters do not constitute a one-to-one mapping);
- except for the manual Morse system, most schemes contain inherent ambiguities, in that certain combinations of Latin letters can represent two different Cyrillic situations, and it is sometimes impossible to tell from context which of the two possible Cyrillic situations had occurred in the original text. (For any mathematicians still reading, they are not an "onto" mapping).

The question which should arise at this point is, "Why?" Why transliterate? Or, if you must, then why in so many different ways? Or even, why worry about the fact that Joe likes the manual Morse system, while Tom likes [redacted] and Harry simply has to have BGN?

The answer to the simplest of these questions is clear, and is probably a derivative or corollary to Murphy's Law: "If Tom, Joe, and Harry,

Table 1

Russian	*Manual Morse*	[redacted]	*Board on Geographic Names*	*Library of Congress*[1]	*International Standards Orgn.*
А	A		A	A	A
Б	B		B	B	B
В	W		V	V	V
Г	G		G	G	G
Д	D		D	D	D
Е	E		E, YE[2]	E	E
Ё	E		Ë, YË[2]	E	Ë
Ж	V		ZH	ZH	Ž
З	Z		Z	Z	Z
И	I		I	I	I
Й	J		Y	I	J
К	K		K	K	K
Л	L		L	L	L
М	M		M	M	M
Н	N		N	N	N
О	O		O	O	O
П	P		P	P	P
Р	R		R	R	R
С	S		S	S	S
Т	T		T	T	T
У	U		U	U	U
Ф	F		F	F	F
Х	H		KH	KH	H
Ц	C		TS	TS	C
Ч	;		CH	CH	Č
Ш	:		SH	SH	Š
Щ	Q		SHCH	SHCH	ŠČ
Ъ	X		"	"	"
Ы	Y		Y	Y	Y
Ь	X		'	'	'
Э	?		E	E	Ė
Ю	$		YU	IU	JU
Я	"		YA	IA	JA

[1] "Modified" system, which omits the diacritics used in the preferred LC system.

[2] E or Ë when preceded by consonant. Otherwise (initial, or when preceded by vowel) YE or YË.

as noted above, keep their data in different transliteration schemes, then they *shall* be tasked to produce a joint report, or else, because of their own respective missions, they *shall* find it absolutely necessary to merge two (or more) of the computer data files involved here."

The answer to the other questions is neither as clear nor as immutable, but is, I believe, dependent upon the availability of resources. Classically:

- we have had Latin-only alphabets on our typewriters, printers, computer character sets, keypunch equipment, CRTs, etc.;

- Latin equivalents were all the other fellow had, when we found it necessary to exchange data; and
- some individuals have preferred working with Russian material in the Latin alphabet, rather than in Cyrillic.

[redacted]

The implication here is that equipment and/or computer processing need no longer represent a requirement or justification to transliterate. This, however, opens a whole new set of questions:

- Do we still have a need to transliterate?
- Why?
- When?

and the still emotionally loaded question:

- Why not just transliterate *everything* and solve the whole problem?

My answers to these questions would be (respectively!): "Yes," "Because," "Sometimes," and "To keep the data unambiguous and to save money."

To expand on that a little, let's consider the question, "Why not transliterate everything?" The reasons for *not* transliterating can be summarized in outline form as follows:

Operational use of the materials

- Most linguists prefer to use Cyrillic. After all, the Russian language is written in that alphabet, and that was the alphabet they had to learn in order to learn Russian.
- Most linguistic working aids (dictionaries, atlases, encyclopedias, etc.) are in Cyrillic (whether Soviet-produced or U.S.-produced).
- Cyrillic text is not ambiguous (if a person's name is spelled with a Ц = TS, there is no ambiguity with names spelled with ТС = TS).

[redacted]

[redacted]

The answers to the other three questions, I believe, will provide the real answer to the transliteration problem. Even given the authority, one would be hard pressed to make an "always/never" transliteration policy that served all. The data needs of users vary widely; data bases are costly to generate and maintain, and are difficult and costly to convert. Lacking a crystal ball, it is difficult to predict what uses may be made of a data file one, two, or five years after its inception. The questions which must be asked, then, are:

- *INPUT?* -- what is the likelihood that this file will have to accept transliterated data as input?
- *STORAGE?* -- what is the likelihood that this file will have to be "mixed" with files in a consistent transliterated form (or in other transliterated forms)?

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[1]CRT = terminal; IMP = Intermediate Message Processor of the ARPA or PLATFORM network; HOST = a "central" computer or main processor.

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- *OUTPUT?* -- what is the likelihood that transliterated output will be required from this file in one or more transliterated schemes?

[redacted]

With these points in mind, it should be apparent that character form requirements should and can be a function of input or output requirements, and that it can be "resolved" more or less dynamically at the user's option. As with most other "dynamic" or changeable programs there is a cost for this, a cost measured in terms of added complexity of programs and run times. While these costs can be lessened by standardization and optimization of the "transliterate" and "un-transliterate" routines, one must consider all three functions -- *INPUT*, *STORAGE*, and *OUTPUT* -- to decide how to handle any given file. Consider the following two cases:

[redacted]

In the first case, Joe's single file can probably get along quite nicely in "transliterated" form. [redacted] As the main use of this data is not linguistic (no mention of transcribers or translators), and is very local (no mention of data exchange or other offices), it would seem that our choice to transliterate is the most cost-effective. Had the choice gone the other way, some conventions would have been necessary to permit input from this "Latin-only" device. These conventions would have required very close scrutiny to insure usability and acceptance by those using the circuit.

[redacted]

COMMENTS AS REQUESTED! (More on the AG-22/IATS)

At the end of his article, "Musings About the AG-22/IATS" (CRYPTOLOG, March 1976), Cecil Phillips asked, "Comments, anyone?" Well, comments he's received! [redacted] "What's Wrong With AG-22/IATS?") appeared in the May 1976 issue of CRYPTOLOG. The following comments which were recently received seem to be worth publishing in full, despite their slight overlappings in treatment. CRYPTOLOG would continue to welcome further comments of a substantive nature on this subject.

Ed.

[redacted] V2:

In his article Cecil Phillips made a strong pitch for altering the HF Morse copying methods as a solution to the unsuccessful efforts to automate the extraction of the [redacted] from Morse traffic through use of AG-22/IATS devices and software. He did not state which target entity was used in the 1960 tests of the first AG-22-type device, but I have always been led to believe that it was the very stereotyped [redacted] traffic intercept. If true, that would explain why the tests were so successful, and why the problems being encountered today are not with that type of traffic, but with other Morse targets which have subsequently been covered with AG-22/IATS equipment. A proposed solution which places the burden on the intercept operator, however, overlooks the limitations of even the best of operators.

No matter how much a Morse intercept operator is taught about his target, he will still not be able to copy very far behind the character being transmitted, especially when unintelligible or unusual information is being intercepted. He cannot take the time to think very much about what is being said in a string of chatter or he will miss part of it. The suggestion for "summarizing" by a Morse operator copying a live target cannot be compared with "gisting" by a voice transcriber who copies from a tape which he can stop at any time. I agree that there is no need for the Morse operator to copy every repeated version of anything, and he didn't in the days before the computer when his only concern was producing a page print. He simply backed up the carriage of his typewriter and spaced along until he detected a change, then typed it in above the original version. Messages were always formatted; nonrepetitious chatter sent in the middle of a message was copied on the margin, or in some cases on a separate typewriter. The operator does not have the same flexibility with the AG-22/IATS; so he must provide continuous copy. Two data streams, one for messages and one for chatter, would clean it up some, but can we afford two recording devices for one operator? And how about [redacted] traffic, where "messages" are not at all like they are in administrative traffic? They are more like chatter.

As for tagging requirements, these should be kept at a minimum, because every added requirement or distraction increases the chances that important transmissions will be missed by the operator. If more tags are added, they should be made optional, which would allow for differences in intercept operator capabilities and speed/difficulty of the target.

Of the three potential solutions presented by Mr. Phillips for improving the AG-22/IATS results, the major emphasis should be on the second, i.e., analytic editing through use of computer terminals. Certainly we should get as much help as possible from the intercept operator, and should develop software to automatically extract as much as possible within technical/manageable limits. We must recognize, however, that major weaknesses exist in both of these approaches which will prevent our ever producing a very good data base from these means alone. We must inject human intervention into the AG-22/IATS conversion process before our formatted activity data bases, which are already poor, become worthless.

A dual-screen terminal arrangement could be used for this, one showing the original version of the AG-22/IATS intercept, and the other showing the data extracted and formatted by the computer. An analyst would judge the accuracy and completeness of the computer record and insert changes/additions as desired. By performing these tasks regularly, he would gain intimate knowledge of his assigned targets and would be better able to detect significant changes than any software package we can ever develop/maintain. The computer would serve best for rapid correlation of stored data from various approaches, especially over a long period. There is no doubt that the best possible activity data base would be built for such processing.

The standard argument against using analysts for this is manpower availability, but that is an argument that managers always fall back on. If necessary, we can make the manpower available by changing mission directions, e. g., by reducing or eliminating SIGINT efforts against countries which allow freedom of movement by foreigners within their borders, and shifting these resources to efforts against the tightly controlled countries, especially the Communists, or maybe even by using some of the programmer billets that are being wasted on the perpetual, unsuccessful conversion efforts. Such major decisions may not be required, though, as I am not convinced that the analysts today are as overworked as their bosses would have us believe. If analysts don't build or correct data files, what do they do with their time? Analysis and reporting takes very little time, if you have good data bases from which to work!

I am afraid we are painting ourselves into a corner as we look more and more to the computers to help solve our real/imagined manning problems. Unfortunately, the old saying "Garbage in, garbage out!" still applies, but who cleans up machine files these days -- especially activity files? Many analysts don't work or even see traffic anymore -- they use selective, formatted machine listings, and I wonder just what kind of a technical education they're getting from working with all of that "garbage." Our product is bound to suffer as the more experienced analysts depart!

A final comment also needs to be made about another aspect of the AG-22/IATS program which is very important in the management of intercept sites. With the high-speed electrical data communications capability we have today, the AG-22/IATS operator's complete intercept can be quickly transmitted back to NSA for processing and analysis. TECSUM preparation at the site, which was initiated years ago to allow for timely electrical forwarding of intercept EEIs and later altered to feed computers, can be eliminated. Field preparation of TECSUMs has never been very good anyhow because the job has usually been avoided by all but the least qualified analysts assigned. Unfortunately, long after installation and activation of AG-22/IATS equipment on many targets, TECSUM preparation is still being required of the intercept sites, the reason being that we still don't have the software to do the job and are unable/unwilling to absorb the TECSUM duties here.

Apparently too many of our managers are living in a dream world regarding AG-22/IATS, and the time for awakening is long overdue. Let's get the analysts involved in cleaning up this mess before their technical capability to do so evaporates.

Wayne E. Stoffel, F8[redacted]

My first reaction to Mr. Phillips' article is that our entire system is geared to the level of inexperience of the collector. With minor exceptions, the Morse collector is a first-term operator, who has not normally encountered manual Morse before joining the service, who was trained by the service, and who may have taken many months to become nominally productive on a Morse position under the instructions "Copy everything you hear." He or she will, by the end of that first tour, have begun to develop some notion about what the target is really doing, but by that time he or she is ready either to get out of the service or to reenlist, thus earning promotion to some other job.

The collector near the end of his tour might be experienced enough to handle more sophisticated instructions (indeed, might welcome them), but he will, as surely as night follows day, be replaced by another beginner who will *not* be able to handle more sophisticated instructions.

Such cyclic infusions of inexperience probably represent a limiting factor for COPES as well as AG-22s. I think that most experienced operators would agree that we ought to rely upon the operator for more judgment and decision functions, but maybe we ought to take a hard look at the level of inexperience of the average collector upon whom we have for so many years relied.

TENNIS Operation Facility:

Since the main point of Cecil Phillips' article is the recommendation to seek the solution for obtaining better results from AG-22/IATS data by changing the way the data is copied, I tried this idea on some senior, civilian career operators here in the TENNIS Operation Facility (TOF). As I was primarily responsible (along with [redacted] Jack Groat, Art Fetcho, et al.) for the development and production of the AG-22 Data Preparation Set which replaced the AFSAV D311, I feel somewhat responsible for the sins that we designers have pushed on the operators and hope to make amends for past mistakes. The following are unedited comments from some of the best personnel in our operation. Their comments are followed by a few of my own.

John Capell, TOF

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[redacted]

To me, Mr. Phillips would treat the symptoms of a "poor quality IATS output" with the wrong cure. A better output depends mainly on dealing with the collector as an individual and his needs, and only marginally with programming procedure, coding procedures, or other quality-control measures. The collector is the farmer of the SIGINT world and produces the product that keeps the rest of us employed. Many people at this Agency often lose sight of this fact; however, I could not accuse Mr. Phillips of this. Thus, the tangent issues he mentions are probably more relevant to the cure than are his main points.

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In my view the quality of the collector output may be suffering because:

- Collectors seem to be left out of the planning cycle on equipment that will affect them. Too often, some manager, engineer, programmer, or analyst will decide what is best for the collection phase of the SIGINT cycle, with the result that the scheme does not meet collection needs.
- The feedback cycle to the collector is very poor. Often, technical documents will be written for internal NSA consumption and be valueless to the collector who needs to use the document most. Many technical SIGINT reports (TSRs) are prime examples.
- The current trend is to ensure collector diversity. Although this has benefits for creating interest, making manning a position easier, and giving a person a wider range of experience, it does prevent the creation of experts. Thus, the in-depth nuances a collector would learn after exposure to the problem are not realized. Knowing "your target" has a lot to do with the quality of the intercept.
- There is a constant influx of new collectors to the various intercept sites. Their training is often haphazard. Secondly, many collectors who no longer want to be collectors are forced to stay at collection jobs. This indicates a need for NSA to establish more job diversity in the collection field. Many only want a temporary break from collection.

A less important aspect of his article was that he seems to belong to the school of thought which assumes that "data gathering with machine manipulation will result in producing value-free information." He alludes to this in his first paragraph. It is my view that time and the devoted research by many social scientists who thought that "quantification and machine manipulation would produce value-free information" has largely disproven this theory. Although larger segments of information can be manipulated, the analysis of the data and the need for the analysis remain. This is one reason why COPES (as a system of collection) is failing -- a lack of proper analysis of the data at hand, with subsequent feedback. This lack of proper analysis is greatly affecting the quality of the output of the collector. I believe that if the feedback procedures improved, then so too would the quality of collection.

Tom McGrath:

In reference to the use of a summary or gist to intercept manual More transmission. This concept is totally unacceptable, from a collector's viewpoint, for one major reason.

All manual Morse transmissions are copied on [redacted] -- is passed in a routine manner. Therefore a summary or gist would not be feasible.

J. D. Rizzutto:

"Gisting" and summarizing, to a degree, has been going on for some time. An example would be when a link repeats [redacted] corrects or repeats text, or repeats the same chatter -- the operator simply makes a comment to that effect. To gist or to summarize beyond this point is not possible when developing new targets or copying erratic targets.

As for developing new equipment and more tags and flags that the operator has to use, the operator should be called on for his views and ideas. This oversight can be seen in the "engineering development" of the TENNIS console. One shortcoming of the TENNIS console is the scope and the keyboard, neither of which is centered within the position. The headset jack protrudes outward from the console and can be broken off by one's body or chair. Not to mention the glare off the scope and the keyboard. If the operators were asked about more tags and flags, one would see that the operator is a very versatile individual. From his past knowledge he may even make the analyst's job easier and possibly enlighten the computer programmer. I am not saying that the operator is all-intelligible, but I am saying that it's about time that he is recognized. For without the operator you are out of a job.

Frank Hyland:

Needless to say, Mr. Phillips' article prompted many comments from members of the several disciplines represented in this office, some of which I incorporate in this response. While I am not uniquely qualified to frame this response, I have had the benefit of having been an SCA Morse Collector, an NSA Traffic Analyst, and having taken undergraduate and graduate training in systems analysis/operations research programming. I have now come full-circle, and am at present working as a civilian Morse collector in G-TENNIS.

Answering the author's points in order will perhaps be the best format, allowing the reader to position both pieces side by side.

At the outset I will state that the objec-

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tives of COPES and IATS formatting, as well as their predecessors and contemporaries, are admirable. During this present period of limited monetary resources, in terms of an "input-process-output" model, NSA managers are attempting to adjust to a relatively minimal "input" (funding) by altering the "process" in order to maximize the "output." Realistically, of course, in terms of game theory, management is searching for the process profile which minimizes the "damage" done to the intelligence effort through reduced funding levels. We know that, with a lesser number of collectors, analysts, and reporters arrayed against a growing number of communication terminals of increasing complexity and sophistication, we cannot realistically seek to provide the same or a high level of service without changing in some way the manner in which we operate.

If we are honest, however, we will not view COPES or IATS as having been chiseled into stone tablets. We are now engaged in a search for the "proper" combination of people and machines, the combination which will maximize the Agency's output under the given set of funding constraints. COPES and IATS are experiments somewhere near the midpoint (hopefully) on the continuum representing the evolution of this search. Having made that statement, though, I must also say that, in terms of a goal attainment-type model, I find some of the activities which are carried out ostensibly to achieve the stated objectives of COPES and IATS puzzling to say the least.

In order, then, these are Mr. Phillips' musings and my own comments:

- *The author states that the joint mechanization group "had great hopes that in four or five years the D-311 would have great impact on the nature of traffic analysis."*

  It has, of course. No argument from me on this one. More later, but suffice to say here that the desirability of this "great impact" is another matter that is open for discussion.

- *"Several recent events have sharply confirmed what I have suspected for some time, that is, the computer records generated totally automatically from AG-22 and IATS are of very poor quality."*

  Again, I can't argue with that, having been afflicted for years with printouts which bore little resemblance to my original request for information. What I do take issue with, though, is the author's solution. At a later point in the piece, he says, *"I think we should change the Morse copying concept from the idea of copying everything to the idea of 'summarizing' or something more comparable to 'gisting' in voice communication."* Morse collectors have known for years, and have tried in vain to tell others, that the significance of a "sked" lies not in the fact [redacted] change and interference levels rise and fall (with the annual salmon run, for all I know). No, what we call the "good stuff" is found in the seemingly smallest of details not found in gists. One transmitting operator persists in attempting to send his traffic despite interference levels which caused others to long since vacate the frequency; another "hangs" on the ends of his B's, so that the next week, when [redacted] verbal sore thumb. It is one thing to *talk about* Morse collectors summarizing a transmission, highlighting the important aspects only. That begs the question: "What is important?" That can be a large issue with the amount of autonomy enjoyed by a collector. And in practice it is demonstrated daily that a mental set ensues wherein the threshold between normal and abnormal is raised until it requires one heck of an abnormality to struggle out of the gist category into the highlight. The situation is not helped at all by the inevitable increase in the output expectations of the collection management staff -- "Well, since you're only summarizing anyway, you can handle those five extra chores."

- *"I do not know exactly why the goal has not been realized. . . there may also be more variation in the data. . ."*

  A good guess. The suspicion that "the computer programs have not been as tightly tailored to the input" is also right on point. The point, however, is that a computer program can *never* be as tightly tailored as is necessary. This agency remains in business basically because of variation. The variation in transmitting equipment, use of radio procedure, and variation in individuals' skill are the means by which we distinguish between nations, services, radio groups, and transmitting operators. To first have a collector wash out a portion of the means by which the analyst can differentiate, and then interpose a machine to further summarize the material seems to me to be antithetical to the agency's stated purpose. It is one thing for the Department of Agriculture to promote the growing of tobacco while HEW spends millions of dollars on cancer research;

for one agency, internally, to spend millions on people and equipment to enable them to [redacted] then spend millions of dollars on equipment and people to erase the elicited variations doesn't seem defensible to me. As a member of the original agency committee which formulated the STRUM program (and, as a traffic analyst, I lived to rue it), I seriously question the wisdom of our adding to the [redacted] have already accomplished.

- *"To sum up, I believe it is time we took a drastic look at the way HF Morse is copied. From what I know of COPES, a start has been made toward what is important in the traffic on a specific or target basis."*

  Correction: A start has been made toward *someone's prevailing idea of* what is important. The difference, I believe, is a very significant one. As a member of the STRUM committee, I was able to wring some invaluable concessions on format flexibility from the group. I was away during the period in which the TENNIS concept and COPES germinated. As a collector, I have to concentrate on *how* I copy at least as much (often more) as I concentrate on the target itself. I pity the poor analysts and reporters who must wade through the machine symbols and the stilted, awkward format to get to my summarized copy, and all the while the situation room or CIA hangs on the other end of the line asking for "more details."

There are many more retorts to more of the author's comments, which could fairly be made. This is enough of a start. Hopefully, many who have been saying silently to themselves, "Lord, deliver me from the computer!" will join the growing number who are saying it out loud.

Jim Norris:

USSID 101 (Annex A, Section I, para 1.4), states, "It cannot be emphasized too strongly that the success or failure of the data flow will will depend on the operator/transcriber following *precisely* the procedure, formats and the correct use of tags as detailed herein."

AG-22/IATS is a classic example of humanity vs. automation. Obviously, very competent operators are required, in order for AG-22/IATS to function perfectly. Competent operators can be acquired or trained. However, emotionless operators who never make mistakes while feeding AG-22/IATS data flow have not yet been hired by NSA.

AG-22/IATS, as well as other software systems does not allow for errors (not even teeny-weeny ones). However, the most competent and industrious operators will occasionally come to work and not feel quite up to par emotionally or physically. Is there a small subprogram, somewhere in the AG-22/IATS system, which will account for any erroneous data flow resulting from this dilemma? Also, does AG-22/IATS provide a subprogram called "motivation"?

The old adage, "You can fool some of the people some of the time, but not all the people all the time," does not apply to the AG-22/IATS program.

In summary: I believe that the current AG-22/IATS program can yield good results -- to a plateau of 90-95 percent of the time. But this depends on competent, motivated operators.

John Capell:

From the above comments, and others I've heard but are unprintable, it is obvious to me that we have the basic cadre of knowledge available to design a better system. This cadre has not been tapped. The TENNIS keyboard and operator's console was designed more than 10 years after the AG-22 and, unfortunately, none of the lessons learned were translated to its new design. The AG-22 keyboard and tagging system has become a "standard" and therefore a contract specification. Unfortunately, MAROON ARCHER is proceeding down the same path. The AG-22 tagging and Overscore Inhibit procedure for copying barred characters were developed solely as a compromise between the machine analysts' desire and the mechanical restrictions of the Teletype Model 35 keyboard. With today's technology of unrestricted keyboard design, it certainly seems that it would be possible to develop a standard keyboard-CRT combination that can be used for Morse collection, for machine data input, and for a clearly readable display with barred characters and proper analyst symbols: one that is both operator designed and approved and is also compatible with standard machine-coding schemes.

Unfortunately, in our horizontal organization this has been too difficult to do and we can't find who to blame for not picking up the AG-22/IATS mistakes in the TENNIS design. The old adage about "experience not keeping you from repeating past mistakes -- it only helps you to recognize that you goofed again" is certainly true in this case.

It is interesting to note that the ADVA/GENS joint mechanization group referred to by Mr. Phillips, the STRUM development committee referred to by Mr. Hyland, and the total AG-22 development were accomplished by PROD with very little R&D input. There seems to be, today, no place left in PROD to do "operational" developments. The movement of these functions and

(Continued on page 26)

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THE GOODKIN COLLECTION SYSTEM

Tim Murphy, B341

Introduction

The GOODKIN Collection System is a highly automated and fully integrated system for acquisition, identification, mission management, collection and processing. [redacted] and, consequently, has potential for significant manpower savings. It is a highly flexible modular system and, to be effective, its software must be tailored to the target. An operational GOODKIN will be purchased for [redacted] but the system must undergo further testing in a live environment and against additional problems prior to further deployments.

[redacted]

System configuration

The GOODKIN prototype is composed of two programmable screener positions (PSP) and eight copy positions. Each type position has [redacted] and a smart terminal keyboard. The PSPs also have [redacted] These positions are supported by [redacted] microprocessors with their associated disc storage. Data input to [redacted] can be accomplished via [redacted] a card reader, or tape drive, whereas a 110-lpm printer serves as an output device in addition to [redacted] and tape drive. Two additional consoles -- generally unmanned -- are available for supervisors and traffic analyst/editors. The system's [redacted] are banked separately -- two of these serving PSPs are automatically controlled by the GOODKIN software. All components of the GOODKIN system are linked by a data-stream controller which permits interaction among all components on a time-sharing basis.

System operation

The GOODKIN system scans portions of the frequency spectrum in accordance with a preprogrammed plan, selects signals of interest, and presents

[redacted]

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[redacted]

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[redacted]

Additional system features

Several additional features of the GOODKIN system make it especially attractive to operators, station analysts, and recipients of the intercept at NSA.

One of the most attractive features for the operator is the drastic reduction in file service requirements. When a case is transferred to a copy operator by an acquisition operator, the former opens his/her file simply by depressing a key. The GOODKIN system's software automatically enters the five standard-format (SF) tags to open the file, and the following lines:

[redacted]

into the file. Nearly all characters entered by the operator represent actual copy or substantive operator comments. File closing is also accomplished by depressing a key.

The operator also has the convenience of working on an uncluttered position. The GOODKIN work environment is a paperfree environment. All copy is recorded [redacted] and then transferred to disc. Hardcopy can be produced for station analysts, however, from the line printer. In addition, no tech data or tasking data [redacted] is required on position, since this data is stored on line and is immediately accessible to the operator.

[redacted]

Unlike an IATS postion, where copy is dumped onto magnetic tape each time the operator hits the carriage-return key, the GOODKIN copy is not transferred to disc until the operator hits the file key -- usually at the end of a

[redacted]

[redacted]

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[redacted]

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[redacted]

The designers of GOODKIN took a systems approach to field station collection. All major functions (acquisition, identification, mission management, collection, and processing) are automated to the extent the state-of-the-art allows. The GOODKIN system's data-stream controller permits virtual [redacted] the GOODKIN operators using the system's hardware/software can accomplish the entire mission.

To date, operator acceptance of GOODKIN has been amazing. Despite a greatly increased workload on the operator, no fatigue problems have been encountered. Operator enthusiasm was sustained even among those who sat at GOODKIN positions for as long as 8 months. Many of the features that make the GOODKIN system especially attractive to operators were incorporated into the system as a result of suggestions solicited and obtained from [redacted] where the GOODKIN specifications were drawn up.

(SECRET SPOKE)

Comments as requested

(Continued from page 17)

engineers from Production to R&D has taken them too far from operational problems. Now they worry about "architecture," "program management," "systems acquisition management," and "system support management." No one is left to do any real operational techniques-development work on a line problem -- at least on a scale that can drive the system-development cycle. Our horizontal organizational structure seems to end up in a Catch-22 whenever someone gets a good idea and tries to pursue it.

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