Meeting Army Foreign Language Requirements with the Aid of Machine Translation

Major Cecil Mac Pherson, Mr. Devin Rollis, Mrs. Irene Zehmisch
Language Requirements Branch
U.S. Army Intelligence Center and Fort Huachuca
Fort Huachuca, Arizona 85613

Abstract

The United States Army has a wide range of language requirements, varying greatly in both the number of requisite languages, and the complexity of the tasks for which language translation is crucial. Machine language translation will be an important part of the support needed to translate documents, monitor news media, and engage non-English speakers in conversation. The machine language translation community has made significant advances in the technology over the past several years, and the Army is looking to both support research and development, and to capitalize on the technology to improve communication and save lives. The Army Language Requirements Branch and the Sequoyah Program Office have received several requests from language technology developers for information on the direction and end-state goals of the Sequoyah program. In this paper, we will attempt to describe the Army's language needs and to document requirements and goals for a machine language translation program.

1 Introduction

The United States Army has always had a need for a foreign language capability. For over two hundred years, the Army has been interacting with non-English speaking peoples whether as allies, opponents, or noncombatant civilian populations. The inability to communicate has often been a challenge and one that has never been adequately met. In military operations, miscommunication can be extremely dangerous and, when dealing with suspicious or distrustful populations, a miscommunication can generate animosity, or even lead to unintended hostilities. Sensitivity to linguistic and cultural differences and the ability to communicate effectively in spite of those differences is an important goal for the Army.

2 Army's Language Requirements

One of the greatest challenges to meeting the Army's foreign language requirements lies in identifying which languages are required in today's rapidly changing environment. The United States Military participates in operations around the world ranging from humanitarian support and disaster relief to training host nation forces and engaging in counterinsurgency or combat operations. Language translation is necessary for planning and executing the full range of military operations from multi-national training exercises through stability operations, small-scale contingencies, and major contingency operations (war). The Army currently has over 250,000 Soldiers operationally deployed to nearly 80 countries[1], and it participates in major multilateral exercises with armies on nearly every continent. With as many as 6,912 living languages in the world, and many thousands more dialects[2], it is impossible to accurately forecast all those the Army will need, or when. There are 21 indigenous languages spoken in Iraq alone, and 47 in Afghanistan. It is neither realistic to think that any language for a contingency deployment will be available; nor to expect to have human translators available for any contingency. With many parts of

[1] Department of the Army, *2008 Army Posture Statement*, (Washington, DC: DA, 2008), URL:<www.army.mil/aps/08/>, accessed 27 May 2008

[2] *Ethnologue*, 15th Edition. Ed. Raymond G. Gordon, Jr. SIL International, 2005.

the world in political turmoil, and millions of people threatened with violence, displacement, and starvation, the Army may be called upon to deploy nearly anywhere in the world on very short notice, and with limited linguistic capability.

Language translation is also critically important in support of intelligence operations, and this area has long gotten the greatest attention. Translation of sensitive or classified information has always been crucial to monitoring actual or potential threats to the nation's security. The Intelligence Community maintains a large population of Soldiers with language skills, and most documented language requirements in the Army are currently within the Military Intelligence Corps. Soldiers monitor threat communications, collect human intelligence from both military and non-military sources, and interrogate captured enemy combatants. When translators are needed by operational commanders, they must often use intelligence Soldiers, thus removing them from their normal critical duties.

2.1 Translators, Interpreters, and Linguists

The Army does have translators in limited numbers whose duties are not strictly intelligence related, but, they are rarely available for the most common translation requirements—at highway checkpoints, security posts, or where Soldiers patrolling city streets must interact with the local civilian population. Soldiers holding the Military Occupational Specialty (MOS) 09L (Interpreter/Translator) provide a translation capability, though for a limited number of languages, focused on the current conflicts in Iraq and Afghanistan. Their primary responsibilities are to translate non-technical written and spoken foreign languages into English, perform oral interpretation, assist contracting and public affairs officers, and screen the local population.

The remedy to the shortage in translator capability in the past has been to hire contract interpreters, either from ethnic populations in the United States, or from the local populace. This can be an extremely expensive solution. The Army recently awarded a contract through 2013[3] for $4.6 billion to provide approximately 7,000 locally hired Iraqi citizens and another 2,200 interpreters who are to be U. S. citizens. Interpreters, particularly locally hired interpreters, can be extremely vulnerable to intimidation or attack. Interpreters in Iraq are frequently targeted for assassination, making it a dangerous job and thereby driving up the cost.

2.2 A Greater Need for Language Capabilities

The Army has a much greater need for foreign language capability than is ever likely to be met by human translators. Today, the majority of the personnel who must communicate with non-English speaking personnel are not themselves translators or linguists. There are simply not enough translators to meet the needs of the services, the joint force, and the national agencies; the number of linguistic points of presence required far exceeds current capacity. Large numbers of phrase books and card sets have been issued, and introductory classes in critical languages have been taught to deploying Soldiers in an effort to fill the translator gap. While these solutions provide wide coverage, they provide only a small improvement in capability.

3 Machine Translation Solutions

The Army has identified machine language translation as a significant part of the solution, though not the ultimate answer, to the continuing translator shortage. Machines will not replace the expertise and flexibility a human translator can provide, but they can be deployed in large numbers; they can be loaded with a new language as needed; they are not vulnerable to intimidation or assassination; and in the long run, the cost will be dramatically less than that currently paid for translation contracts.

To provide this machine foreign language translation capability, the Army is developing the Sequoyah–Foreign Language Translation System. The systems will provide a militarily useful capability for rapid, two-way foreign language translation of both speech and text at all echelons. Sequoyah will enable people with little or no knowledge of the local language to communicate at a basic level, thus freeing translators and linguists to perform higher level and more

[3] GLS Moving Forward With $4.6 Billion Translation Contract, URL:<//www.gls-corp.com/>, accessed 27 May 2008

technical functions for which they are better suited. Sequoyah will support rapidly deploying forces and first responders when linguistic support is minimal or unavailable. Sequoyah will provide deployed forces the ability to conduct rudimentary, cross-lingual communications in cooperative and non-cooperative environments anywhere the mission might take them.

3.1 Sequoyah–Foreign Language Translation System Requirements

Sequoyah will provide a family of software products including translation engines and mission-oriented language modules. Sequoyah will not be a "one-size fits all" program. Translation engines and language modules consequently will vary by platform, purpose, developer, operating system, and software application. The system will be integrated, scalable, tailored, interoperable, user-friendly, easily deployable, and available at all echelons. Access to the program will be provided through the Global Information Grid (GIG) via various web-based interfaces as well as software applications for use on mobile and portable automation systems. It will be interoperable with commercial and government-developed automation systems, including the Net Enabled Command Capability (NECC), the Distributed Common Ground System (DCGS), Battle Command System (BCS), Soldier as a System (SaaS), Future Combat System (FCS), DoD Intelligence Information Systems (DoDIIS) and any associated devices and peripherals. Sequoyah users will be able to access additional linguistic resources such as new language and domain modules or updates to existing locally stored modules through the GIG. A language module will consist of translation engines, dictionaries for English and the target language, and mission-oriented domains required to conduct speech and text translation.

Sequoyah will provide three modes: speech-to-speech, text-to-text translation, and a foreign media monitoring capability. These three modes of service are web-enabled, mobile, and portable.
The web-enabled service will provide a centralized, server-based translation capability accessible via the GIG. Users of this capability may have a software front end on the mobile version that is installed locally but primarily relies on the more robust capability accessed over the GIG.

The mobile application will be installed on a local platform such as a desktop or laptop computer and will operate primarily from that platform, with software and language module updates available over the GIG. The mobile capability will likely be more limited than that available through GIG access, but it will be a local capability which would remain available in the event GIG access were interrupted. The mobile platform will receive software updates and language module downloads via the GIG.

The portable application will provide speech and text translation support as modules installed on handheld or wearable systems. These are systems a Soldier can carry or wear while conducting nearly any mission, and which have no GIG access during the conduct of that mission.

The Sequoyah program will initially provide speech-to-speech modules for 10 languages and text-to-text modules for 28 languages. This is referred to as the threshold capability, or the minimum initial production level. The program's objective is to provide speech-to-speech modules for 14 languages and text modules for 50 languages. The language priority will be established by the Defense Language Steering Committee. A surge capability will be available to meet immediate "unprogrammed" translation needs. This surge capability will allow for rapidly producing and deploying off-the-shelf, already-developed linguistic resources – to field new language modules and domains on demand. This capability will enable Sequoyah to meet urgent needs such as those created by humanitarian emergencies or quick reaction military operations.
The qualitative standard set for the Sequoyah program is the scale established by the Interagency Language Roundtable (ILR), the official U.S. Government measure for language skill level. The ILR standard is used to measure the skill level of Army translators and linguists. Using the same standard for machine language translation will ensure the machine is capable of aiding the Soldier in completing tasks involving communication with a non-English speaker.

The speech-to-speech (S2S) capability will support a wide array of missions at all echelons but is focused primarily on Soldiers performing low level tasks while interacting with non-English

speaking persons. These may be coalition partners, enemy combatants, civil authorities, or the civilian populace within the area of operations. The S2S device is intended to aid a Soldier in communicating with persons in the local language at a basic level.

The speech-to-text (S2T) capability will be used primarily to support radio and television media monitoring, although it will also be used for non-media speech. Media monitoring is critical to understanding what is going on in the local community as well as understanding public opinion of allied forces. It reflects what they are being told by their public and religious leaders. It is also important to an information campaign. Monitoring the local media can help analysts to understand whether coalition public announcements are having the desired effect on public opinion.

The text-to-text (T2T) capability will enable the translation of a wide range of documents, from pocket litter (such as paper scraps with hand written notes) to technical publications. It will also aid translation of on-line content such as web pages, posted documents, and chat between speakers of multiple languages. The translation capability required for T2T will generally be more technical than that required for either S2S or S2T due to the typically more formal, and often technical, content of written over spoken language.

3.2 Mission-Oriented Language Domains

In developing a machine language translation capability to meet military requirements, it is important to note that military language is so riddled with terms, acronyms, and jargon that it sometimes seems to need translation even into English. While a number of developers are working on military-oriented machine language translation products, and some have been fielded, most commercial products were developed for industry, medical services, or tourism.

To ensure the system provides military utility, the Sequoyah program must focus translation capability while limiting the physical memory and processing capacity required. This will enable its use on portable translation devices. Sequoyah language modules will meet this requirement by focusing on mission-oriented domains. These domains will represent doctrinal missions and be further focused through the identification of critical Soldier tasks. The machine language translation capability or device must aid Soldiers in completing mission critical tasks while interacting with non-English speakers.

3.3 Sequoyah Development

The Sequoyah program will be implemented in three incremental phases based on increasing complexity of the technological requirements. In addition to the complexity of the technology involved, the system will be required to provide translation capability at increasingly higher ILR levels.

Increment I will provide initial capability, and is further divided into execution phases designated IA and IB.

- Increment IA requires development of speech modules for 10 languages and text modules for 10 languages to meet immediate wartime requirements.
- Increment IB requires development of speech modules for an additional 4 (objective) languages and text modules for an additional 18 (threshold) and 40 (objective) languages.

Increment I will provide the following threshold and objective capabilities:

- A two-way, phrase-based (threshold) speech capability and unconstrained (objective) speech capability.
- A S2S capability at a (threshold) ILR level of 1 and an (objective) ILR level of 2.
- A two-way (threshold) T2T capability at an ILR level of 1+ and an (objective) ILR level of 3.
- A one-way (threshold) text-to-speech capability at an ILR level of 1+ and an (objective) ILR level of 3.
- A (threshold) speech-to-text capability at an ILR level of 1+ and an (objective) ILR level of 3

Increment II requires the addition of language and dialect recognition for speech and text for all previously developed languages. Initiation of Increment II will be driven by individual language technology readiness levels rather than by timeframe. Therefore, Increment II will not be bound to sequential initiation following delivery of Increment I capabilities, but should be developed

in parallel as technology matures.

Increment III will provide a speech and text translation capability with a threshold ILR level of 2 and an objective ILR level of 3. This increment will also add a requirement for keyword handwriting recognition to the text translation capability in the web-enabled and mobile configurations for all previously developed languages. As with Increment I, initiation of Increment III will be driven by individual language technology readiness rather than by timeframe. Increment III will also not be bound to sequential initiation following delivery of Increments I and II capabilities, but should be developed in parallel as technology matures.

3.4 Quick Reaction Capabilities

Sequoyah is a developmental program and does not, as yet, have any applications or language modules available for fielding. To meet immediate operational requirements and test the current state of technology, the Sequoyah Program Office began issuing Quick Reaction Capabilities (QRC)—commercial speech-to-speech translation devices—in 2005 to units deploying to Iraq and Afghanistan. It has also fielded a multilingual chat capability and a media monitoring system to several Combatant Commands. These QRCs have met with varying levels of success and are providing the program a sense of the available technology as well as the direction commercial machine language translation tools are going.

3.5 The Sequoyah–Foreign Language Translation System

Army language requirements are wide-ranging and constantly evolving. The capability to communicate with non-English speaking peoples is important to the accomplishment of nearly any mission, and vital to avoidance of unintended, and potentially dangerous, misunderstandings. Human translators, whether in uniform or under contract, cannot be everywhere their skills are needed. Machine language translation will go far toward providing a basic language capability down to the lowest echelons while allowing trained translators to focus on the higher level translation missions more suited to their abilities. The Sequoyah–Foreign Language Translation System will provide that capability. It will enable Soldiers to communicate more easily, and retain the flexibility to react to changing missions or unanticipated emergencies in the future.

The Sequoyah program has been approved by the Army and Joint Staff, and is now a program of record with budgeted funding for research and development beginning in fiscal year 2009. This means the program now has funding to support development. The Sequoyah program has an ambitious development agenda and it is likely that multiple partners in industry will be involved in producing the technology and the language data. We encourage machine language translation researchers and developers to support this exciting program by becoming directly involved in the research and developing the tools that will help Soldiers communicate.

4 Conclusions and Future Work

The Army's foreign language requirements require a variety of solutions. Machine language translation, and the Sequoyah program in particular, will be an important part of those solutions. While there have been significant recent advances in the technology, it still requires developmental investment to reach the level of maturity Soldiers need to succeed in the field.
Researchers and developers in the field of machine foreign language translation are encouraged to participate in this exciting program. The Sequoyah Program Management Office will periodically issue announcements and requests for information through federal contracting venues such as www.fedbizops.gov.

References

Department of the Army, *2008 Army Posture Statement*, Washington, DC, URL:<www.army.mil/aps/08/>, accessed 27 May 2008

Department of the Army, *Sequoyah–Foreign Language Translation System Capabilities Determination Document*, U.S. Army Intelligence Center, 2008, Fort Huachuca, AZ

Ethnologue, 15th Edition. Ed. Raymond G. Gordon, Jr. 2005, SIL International.

Global Linguist Solutions, *GLS Moving Forward With $4.6 Billion Translation Contract*, 13 March 2008, Falls Church, VA, URL:<//www.gls-corp.com/>, accessed 27 May 2008