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Evolving the US Army Research Laboratory (ARL) Technical Communication Strategy

**by Jean M Vettel, Jennifer Mullins, Garrett Warnell, Karin
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Evolving the US Army Research Laboratory (ARL) Technical Communication Strategy

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Acknowledgments

This report was written by a subset of the committee, but the content reflects discussions across the members of the group both within and outside the working group's meetings. To represent differing levels of connection to the articulation of ideas in the document text itself, those who wrote sections of the document are listed as authors while those who participated in at least one working group discussion are listed as committee members.

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Executive Summary

The US Army Research Laboratory (ARL) must evolve technical communication strategies to enhance its mission. Benefits will include international recognition of ARL scientists, wider impact of ARL scientific accomplishments, easier recruitment of top-notch employees, attraction of more customer funding through strong demonstration of added value and enhanced tech transfer, and strengthened relationships with academic and industry collaborators. In support of increasing ARL's impact, an internal ARL Technical Communications Working Group (TCWG) was formed to consider the following questions:

1. Who is our audience?
2. What is our technical message?
3. How should we convey it?
4. How often?
5. What outcomes do we want from these communications?

While nuanced answers to questions are embedded in the appendices, the TCWG consolidated the main findings from their research and discussions, and the group recommends a 3-prong, near-term technical communication strategy for the laboratory. This strategy is summarized here, but suggested implementation approaches are described in the main text of the report.

Prong 1: Modernize the Online Communication Strategy

- 1) *Enhance online presence* – Extend a more detailed, multimedia web presence that is open to edits from the team and researcher level. Create individual and/or team research webpages with improved keyword tagging and subscription capabilities. Develop a webpage update component to update publications through ARL approval and metric database processes, such as ARL's "Form 1" review process.
- 2) *Enable the active generation and distribution of ARL science and technology (S&T) advancements* – Increase the density of ARL's "technical" articles and actively distribute ARL content into popular media, using selection criteria that accurately represents ARL's investment in the technology and benefits to the Army.
- 3) *Leverage established S&T audiences* – Invite established social media representatives (e.g., YouTube hosts with high visibility) to feature ARL research on their respective websites.

Prong 2: Improve Workforce Technical and Strategic Communications Skills

- 1) *Enhance strategic messaging* – Teach the work force to increase the consistency of the ARL strategic message within their presentations and publications.
- 2) *Improve public communication skills* – Work with the Public Affairs Office to train the workforce how to give bottom-line-up-front summaries, 2-min elevator pitches, and similar concise research descriptions to nontechnical audiences. Provide regular workshops on writing skills and public speaking (e.g., Toastmasters).

Prong 3: Promote a Stakeholder Database

- 1) *Implement a stakeholder database* – Use a customer relationship management system to improve the consistency of communication with customers, maintain a list of stakeholders and their preferences, and gain insights about our communication practices. One possibility is to use the Survivability/Lethality Analysis Directorate's ARL Collaboration Tools and leverage the invitation lists from recent ARL Program Formulation meetings.

1. Introduction

At the beginning of fiscal year 2016, Dr Joe Mait, the US Army Research Laboratory's (ARL) Chief Scientist, charged Gabe Smith, Chief Scientist technical assistant to the director (TAD), to organize and chair a Technical Communications Working Group (TCWG) that reviewed ARL's existing technical communication practices, evaluated their efficacy, and derived an ARL technical communication strategy. The working group was formed by selecting an individual or 2 from each directorate who are seen as strong communicators of the ARL message by ARL headquarters and VIP visitors, and the committee chair hosted teleconferences to enable multidisciplinary discussion about the current state of the art in technical communication both within and outside the laboratory.

The scope of the group's technical communication review was focused on the ARL scientific message outside of the "traditional" means of science communication challenges. All research groups, including ARL, have a consistent challenge to increase the speed and quantity of research results converted from data analysis to journal articles/technical reports. All research groups also face the challenge of how to communicate results to a multidisciplinary audience where individuals have disparate research expertise and specialized jargon (e.g., material scientists communicating with biologists). Instead of these 2 widespread research communication challenges, ARL's TCWG focused on challenges in the communication of the ARL scientific message to particular communities:

- Scientific laboratories who do not know that the Army has a fundamental research program led at ARL
- Larger "Big Army" arena, including the Assistant Secretary of the Army (Acquisition, Logistics and Technology) (ASA(ALT)), Training and Doctrine Command (TRADOC), Office of the Secretary of Defense, and so on
- General public about the value of Army science and technology (S&T) on taxpayer money

Within each community, the desired outcome is different, so the message and its delivery should be optimized for the desired goal. For example, if the goal is to attract high-quality postdocs to ARL, then collaborating with researchers outside of ARL, publishing in journals and conferences, and being active in the scientific community should be part of the technical communication strategy. However, if the goal is to build support for Army S&T within the general public, then community outreach, mass media, and concise, persuasive messages should be the strategic

centerpiece. To narrow the scope of our investigation for this report, we emphasize recommendations to extend ARL's recognition within the scientific community, build support for Army S&T within the general public, and inform senior decision makers in our Army and Department of Defense (DOD) leadership. During our group meetings, the committee discussed a host of additional topics, including what metrics could measure the success of our technical communication, how we could increase impact without undue burden on ARL's research community, and what strategies would give the biggest return from existing capabilities and practices within the laboratory.

In this report, TCWG proposes a 3-prong, near-term technical communication strategy for the laboratory with 6 suggested actions to lay the ground work for a robust technical communication strategy. The first prong recommends that ARL modernize our online communication strategy, providing avenues for research-level websites with cutting-edge content that can be edited by ARL scientists and populated through existing metric collection procedures. In addition, we also suggest an increased focus on "technical" articles for popular media and inviting YouTube shows with an existing S&T community to feature ARL research on their channel. In the second prong, we suggest targeted training in both Army-focused strategic messaging as well as concise and engaging research summaries for nontechnical audiences. Finally, in the third prong, we recommend creating a stakeholder database to facilitate consistent, bidirectional communication.

This report also contains several appendices that include several summary tables, meeting notes, and metric lists that were led by various members of the working group to develop these action items. We include the "raw data" in the Appendix to minimize duplication of effort for future iterations of this working group.

2. Prong 1: Modernize the Online Communication Strategy

A primary goal of the TCWG was to suggest ways to improve ARL's visibility "outside the fence line". Improved recognition would enhance ARL's reputation as a premier laboratory beyond DOD by broadening and expanding our reach to general audiences, scientific communities, and potential collaborators. Our recommendation for modernizing ARL's online communication strategy has 3 major components: enhancing our online presence with dynamic content from ARL scientists, writing an increased number of "technical" articles for popular media to actively distribute ARL S&T advancements, and inviting YouTube shows with an existing S&T community to feature ARL research on their channels and leverage established audiences of prominent external S&T individuals and organizations. It is the TCWG's consensus that ARL is disproportionately underrecognized as an

organization given its size and quality of work when compared to peers within the DOD, other Government labs, and academia, although significant improvements have been made recently.

2.1 Enhanced Open Online Presence

2.1.1 Individual and/or Team Research Webpages

For ARL to more effectively communicate its overall technical message, collaborate with state-of-the-art researchers, and increase the reputation of its research staff, TCWG recommends that ARL enhance its web presence with multimedia content at the team and researcher level where scientists are able to contribute content. Specifically, we recommend that the Chief Scientist commission 2 to 3 volunteer research groups to develop pilot, public-facing research websites. These websites should be selected from various organizational levels (i.e., Campaigns, Directorates, Divisions and Branch, Team, and Individual). These pilot sites will undergo a review-and-revise process with the Operations Security Office (OPSEC) and Public Affairs Office (PAO). Upon completion of this process, we recommend that the Chief Scientist review and select one of these websites as a template to be made available to qualifying ARL research groups. Groups may then use this template to more effectively convey their specific technical message to both internal and external audiences. Importantly, TCWG also recommends that both the decision to create the website and decisions pertaining to updating the website (proposed content, frequency of update, etc.) come directly from the researcher(s) or group(s) that the website describes.

One of the most effective ways in which today's scientists are able to communicate their technical work, message, and expertise is via a research website. While there is no explicit standard format for these websites, they often contain content such as 1) a brief biography and list of research interests; 2) contact information; 3) a news section that contains brief research updates; 4) a page that describes current and past research projects, perhaps with multimedia such as YouTube videos; and 5) a list of publications, data sets, software, and so on that are easily accessible via embedded links. These research websites are often the first stop for contacts made at conferences, industry partners seeking expertise, and other potential collaborators. Screenshots from such websites in academia, other DOD labs, and industry can be found in Figs. 1, 2, and 3, respectively.¹⁻³ Interesting research websites are living sites, updated frequently so a viewer sees the latest, most relevant work.



Welcome

VIJAY KUMAR is the Nemirovsky Family Dean of Penn Engineering with appointments in the Departments of Mechanical Engineering and Applied Mechanics, Computer and Information Science, and Electrical and Systems Engineering at the University of Pennsylvania. Kumar's group works on creating autonomous ground and aerial robots, designing bio-inspired algorithms for collective behaviors, and on robot swarms. They have won many best paper awards at conferences, and group alumni are leaders in teaching, research, business and entrepreneurship. Kumar is a fellow of ASME and IEEE and a member of the National Academy of Engineering. See short bio and picture (low res, high res t/d download).

News

- Yash Mulgsonkar and Spencer Penn featured in Forbes' "30 Under 30: Science and Social Entrepreneurs" list January 04, 2016
- Amanda Prorok, Ani Hsieh and Vijay Kumar awarded Best Paper at BICT 2015 November 13, 2015
- Ed Steager and Denise Wong lead research at the intersection of synthetic biology and micro robotics November 13, 2015
- Penn's GRASP Lab Receives \$5.5 Million for Fast, Light and Autonomous Flying Robots November 05, 2015

Recent Highlights

Planning and Control o...
Planning and Control of Aggressive Maneuvers for Perching on Inclined and Vertical Surfaces.

Recent Publications

Fink, J. and Ribeiro, A. and Kumar, V.
Robot Control of Mobile and Communication in

Fig. 1 Academic research website: Vijay Kumar, University of Pennsylvania, www.kumarrobotics.org (reproduced with permission)¹

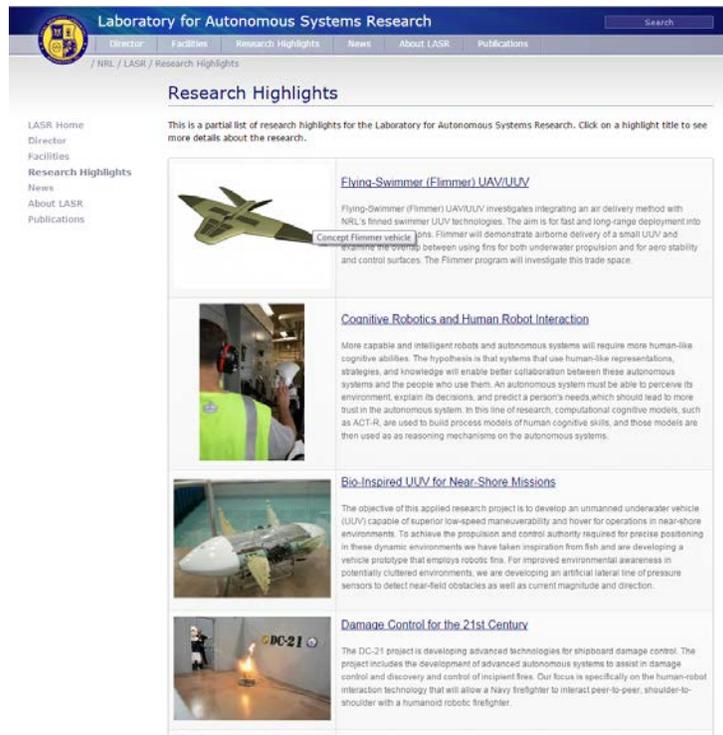


Fig. 2 DOD lab research website: Laboratory for Autonomous Systems Research, US Naval Research Laboratory (NRL), www.nrl.navy.mil/lasr²

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Fig. 3 Industry research website: Petros Boufounos, Mitsubishi Electronic Research Laboratories, www.merl.com/people/petrosb (reproduced with permission)³

While the current content of the ARL website conveys scientific and strategic information at a coarse level, many changes could increase the target audience and also communicate more detailed descriptions of scientific work at a deeper technical level. The current ARL webpage provides a place for a brief description of the work done on a branch level and also provides a searchable list of ARL technical reports (TRs) (see Figs. 4 and 5). However, this is not enough to effectively convey our technical message to the audiences we wish to reach. For example, if a potential collaborator meets an ARL researcher at a conference, the only current way in which they can get further information is to visit www.arl.army.mil⁴ and search the TRs by author. There are several reasons why this process is unsatisfactory. Among them are 1) reading a series of TRs is not a time-effective way to get an overview of a researcher’s technical work; 2) not all publications written by an ARL researcher have necessarily been made into a TR; 3) TRs do not necessarily contain the authors’ contact information; 4) this only works if the ARL researcher’s name is remembered. It is not currently possible to navigate the ARL webpage with a research area in mind and find a publication list or contact information for a researcher or research group. Corporately, ARL is going to great efforts to connect our researchers with external collaborators. If a researcher cannot be found on the website, it will be the broken link in that chain, potentially ending the collaboration before it starts.

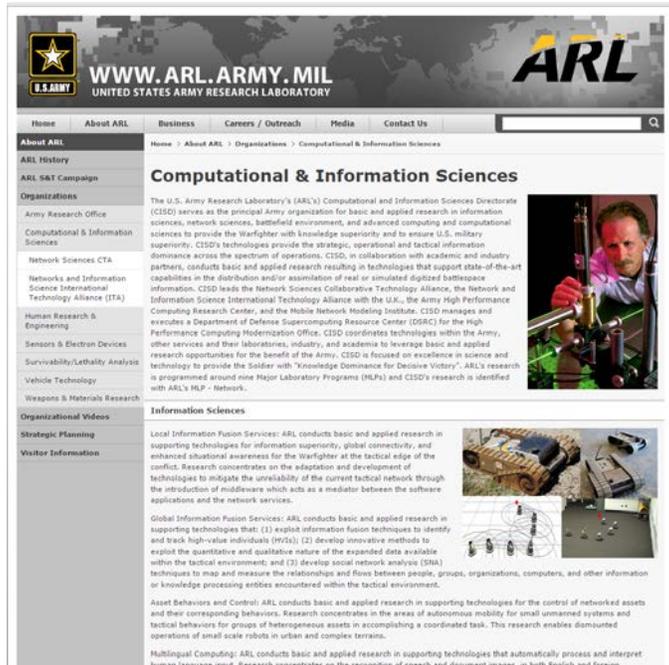


Fig. 4 Current ARL external website.⁴ Branch-level research is described with a single paragraph.



Fig. 5 Current ARL external website.⁴ TRs are searchable but not presented in the context of a research group or researcher.

An ARL website with several, more-detailed research websites as described previously would address the concerns with the current format. Visitors could find a group's website by topic area rather than individual name. Brief summaries of research projects and researcher biographies could quickly and effectively convey the group's technical message and technical expertise. A list of all publications, ARL TRs and otherwise, could provide more details if desired. Readily available contact information would make it easy to for potential collaborators to connect directly with ARL researchers. Moreover, this type of web presence and visibility

would make it easier for ARL research groups to become recognized in the research community.

This recommendation clearly comes with several concerns that fall under the purview of ARL's OPSEC and PAO. Given the potential level of detail and aggregate information, for example, the working group acknowledges that such websites will only be appropriate for unclassified research and researchers, such as those involved in Open Campus/Open House (OCOH). Further, given the fact that these websites will represent ARL to the general public, the working group also acknowledges that the specific format will likely need to be carefully selected and strictly followed. It is for these types of reasons that we specifically recommend that the pilot websites be developed according to a review-and-revise procedure with both OPSEC and PAO. Moreover, all website content will be properly vetted in the Form 1 process using the website form. Though unlikely, the TCWG understands that Document A and Document B can independently be Distribution A, but A+B may convey too much information to our adversaries. For this reason, all websites will be reviewed. If a version of such a website can be produced that meets the requirements of both offices, we believe that it will be a powerful and effective tool in ARL's ongoing effort to communicate with its target audiences.

TCWG recognizes that the proposed website style may not be appropriate for all researchers or research groups within ARL. For this reason, it is our recommendation that the decision to create a website be left to the individual or team that the website describes. Furthermore, we recommend that decisions such as proposed content, frequency of update, and so on also originate at this level. It is our belief that healthy, up-to-date, dynamic content can only result from the personal involvement of those creating that content, and as such the process of creating these websites should be strictly opt-in. To assuage concerns about the quality or type of content being proposed by individuals, ARL could offer training or guidelines on the type of content that is expected.

As a final note, TCWG is currently aware of at least one research group willing to participate in the pilot: the Computational and Information Science Directorate's Asset Control and Behavior Branch.

2.1.2 Keyword Tagging and Subscription Capabilities

As ARL continues to pursue OCOH forums, collaboration opportunities, outreach, and recruiting initiatives, it is crucial that ARL's research be more easily available to general audiences and scientific communities unfamiliar with the lab and its research. To aid in this, the *TCWG recommends adding keyword tagging and subscription capabilities to the external ARL website*. These capabilities should be

applied not only to ARL’s publically released articles, but also to the recommended individual/team research webpages.

Keyword tagging will allow individuals to quickly locate articles and webpages relevant to their particular interests, whether it be biology, cybersecurity, materials science, or another area. In this way, the individual can quickly gain an understanding of ARL’s research interests and most recent work in a given field. In its current state, the ARL website provides a series of articles archived by date. While this allows users to gain a general understanding of ARL, users would have to view multiple pages and sort through all of the articles to identify those of particular interest to a given field. Examples of Sandia National Labs (SNL)⁵ and Defense Advanced Research Projects Agency (DARPA)⁶ keyword tagging are shown in Figs. 6 and 7.

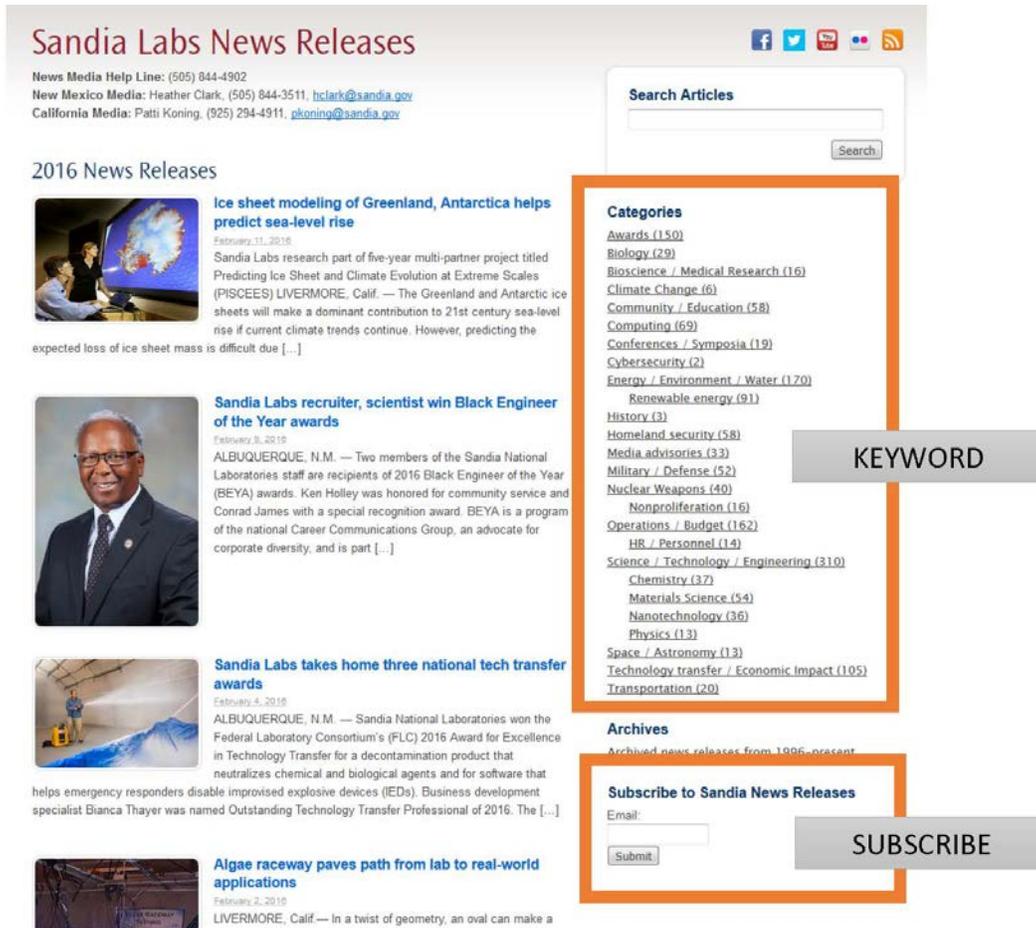


Fig. 6 Snapshot of SNL’s webpage⁵ shows recent news releases. Keyword filtering on the right allows viewers to easily find articles related to their interest, such as “Biology”, “Cybersecurity”, “Chemistry”, “Physics”, etc. Subscription capability on the bottom right allows viewers to stay current on the most recent articles published by the lab.



Defense Advanced Research Projects Agency > Tagged Content List

The screenshot shows the DARPA website's 'Tagged Content List' for 'Sensors'. On the left, a 'FILTER RESULTS' sidebar lists various categories under 'Content Type' and 'Related Topics'. The main content area displays three news items, each with a date, title, and a list of keywords. The first item is 'Parts for the Hubble Space Telescope' (01/01/1978) with keywords: History, Materials, Satellites, Sensors, Space. The second is 'Human-Machine Systems' (05/18/2015) with keywords: Complexity, Fundamentals, Materials, Math, Sensors. The third is 'Mathematics/Modeling/Design' (05/18/2015) with keywords: Autonomy, Complexity, Fundamentals, Materials, Math, Sensors. The fourth is 'Physical Systems' (05/18/2015) with keywords: Autonomy, Complexity, Fundamentals, Materials, Math, Sensors. Orange boxes highlight the 'Showing 90 results for Sensors' bar and the 'Sensors' keyword in the first item. A grey box labeled 'KEYWORD' points to the 'Sensors' keyword in the second item. Another grey box labeled 'KEYWORDS' points to the entire keyword list of the first item.

Fig. 7 Snapshot of DARPA’s webpage⁶ shows recent news releases, filtered for “Sensors”. Keyword filtering on the left demonstrates ability to further refine the viewer’s search for articles based on a given researcher’s interests.

Adding subscription service capabilities would allow interested individuals to stay up to date with ARL’s latest information. Subscription service capabilities could be added to the news releases and individual/team research webpages. While NRL⁷ and DARPA⁸ offer subscription capabilities as shown in Figs. 8 and 9, ARL does not currently offer this capability on its website.

Field Sites | Visitor Info | Contact NRL | Search

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December 18, 2015
NRL Developed Micro-UAV Named POPULAR SCIENCE 'Best of What's New'
The popular science and technology publication awards the Close-in Covert Autonomous Disposable Aircraft (CICADA) micro disposable air vehicle the 2015 Best of What's New Award in the category of Aerospace.

November 17, 2015
NRL Researchers Recruit Luminescent Nanoparticles to Image Brain Function
The ultimate goal is to better understand how the billions of neurons in the brain communicate with one another during normal brain function or dysfunction as result of injury or disease.

October 6, 2015
NRL Rocket Experiment Tests Effects of Dusty Plasma on the Ionosphere
NRL, in collaboration with numerous universities and government laboratories, will use data gathered from the experiment to study the effects of dusty plasmas — thought to be a source of radio interference.

September 15, 2015
3000th 'Sungrazer' Comet Imaged by NRL Space Instrument LASCO
On September 15, Karl Battams—a computational scientist at the U.S. Naval Research Laboratory (NRL)—confirmed the discovery of the 3,000th near-sun comet using an NRL instrument. "We are taking images of the region of space that surrounds the sun," says Battams, "and this allows us to see small objects very near the sun that would otherwise be invisible from earth." The images come from NRL's LASCO instrument, which orbits on the SOHO spacecraft.

NRL's Dr. Jerome Karle was a co-recipient of the 1985 Nobel Prize in Chemistry for his work in determining molecular structure.

NAVAL RESERVE PROGRAM
Research opportunities at NRL for Naval Reservists with science and technology backgrounds are available through ONR's Program 29.

ACCEPT THE CHALLENGE
NRL's facilities and equipment for conducting your research are world-class. Find out more about joining NRL.

Fig. 8 Snapshot of NRL's webpage⁷ shows recent news releases. At the top is an easy option to subscribe to new posts, allowing viewers to stay current on the most recent articles published by the lab.

Subscribe to this feed using Live Bookmarks Always use Live Bookmarks to subscribe to feeds. **SUBSCRIBE**

DARPA Tags RSS

DARPA Tags RSS Feed

[Parts for the Hubble Space Telescope](#)
Sunday, January 01, 1978 12:00 AM
The National Aeronautics and Space Administration's (NASA) Hubble Telescope takes the clearest images of the universe. The telescope demonstrates the advantages of metal matrix composites.

[Human-Machine Systems](#)
Monday, May 18, 2015 12:00 AM
Integrated technologies to enhance warfighter capability and survivability

[Mathematics/Modeling/Design](#)
Monday, May 18, 2015 12:00 AM
New tools for modeling complex phenomena, networks and systems

[Physical Systems](#)
Monday, May 18, 2015 12:00 AM
Physics, chemistry, and materials for new national security capabilities

[Defense Sciences Office](#)
The Defense Sciences Office (DSO) identifies and pursues high-risk, high-payoff fundamental research initiatives across game-changing technologies for U.S. national security.

[Defense Sciences Office](#)
Sunday, May 17, 2015 12:00 AM
The Defense Sciences Office (DSO) identifies and pursues high-risk, high-payoff fundamental research initiatives across game-changing technologies for U.S. national security.

[ARPA Midcourse Optical Station](#)
Sunday, January 01, 1961 12:00 AM
With the goal of developing an astronomical-quality observatory to obtain precise measurements and images of satellite potential of AMOS had been demonstrated, and a second phase began to measure properties of reentry bodies at the station and ranging were initiated.

[Arecibo Observatory](#)
Friday, January 01, 1965 12:00 AM
Located in Arecibo, Puerto Rico, the Arecibo Observatory houses the world's largest single-dish radio telescope. The g

Fig. 6 Snapshot of DARPA's webpage⁸ shows the ability to subscribe to DARPA's latest releases via an RSS feed, allowing interested viewers to keep up to date on the latest releases from DARPA

2.2 Active Generation and Distribution of ARL S&T Advancements

2.2.1 Increase Density of ARL’s “S&T Interest(Technical)” Articles

ARL generates a similar number of articles to its sister laboratories, for both internal and public release in the course of the year. Between January 1, 2015, and December 31, 2015, ARL published a total of 66 articles to ARL’s external website (<http://www.arl.army.mil>).⁴ Articles covered such topics as OCOH, strategic plans, personnel profiles, organizational restructuring, awards, visiting officials, summer student research, and research advances in S&T. The number of articles generated by ARL is comparable to other DOD and Federal laboratories such as the US Air Force Research Laboratory (AFRL), DARPA, Lawrence Livermore National Lab (LLNL), NRL, and SNL, as shown in Fig. 10.

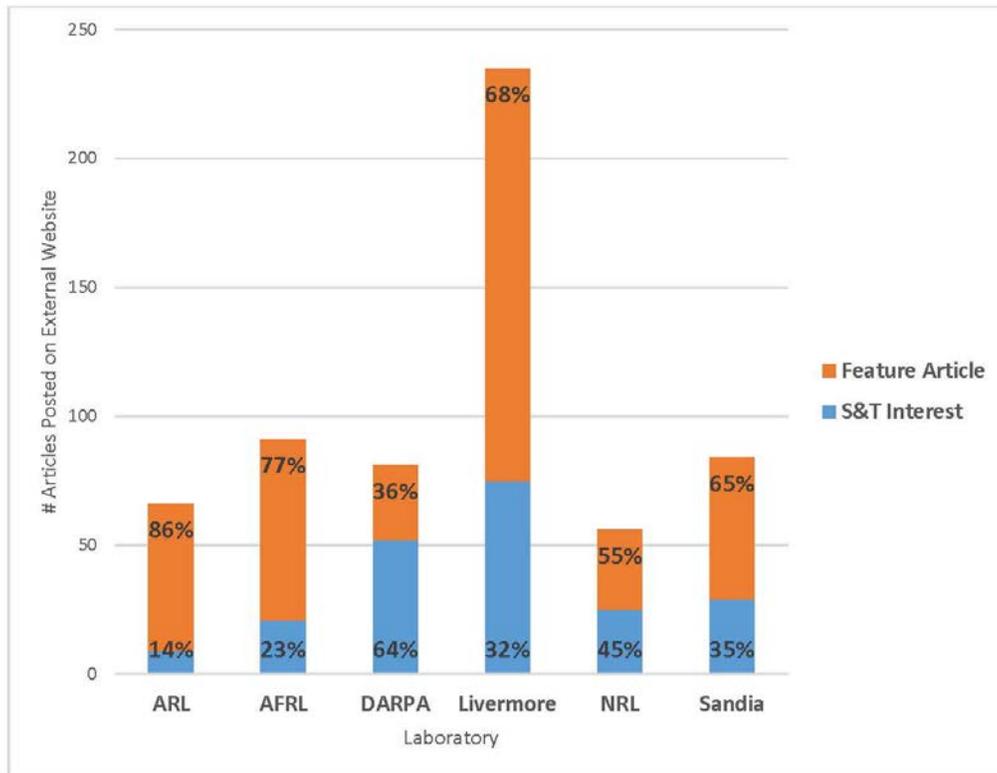


Fig. 7 Number of articles posted on each respective organizations’ external website from January 1, 2015, to December 31, 2015. Of those articles posted, they were categorized as either “technical” or “feature article”. “Technical” articles are shown on the bottom in blue; “nontechnical” are shown in orange on top. (Given that the delineation between “feature article” and “technical” is somewhat imprecise, the data shown here are intended to be viewed as a relative comparison among laboratories rather than absolute values.)

While the number of ARL articles is comparable to other labs, the percentage of “technical” articles is lower, at approximately 14% as shown in Fig. 10. By

comparison, AFRL, LLNL (Livermore), and SNL (Sandia) ranged from approximately 23% to 35% “technical” articles, whereas the NRL and DARPA posted 45% and 64% “technical” articles, respectively.

For the purposes of this analysis, “nontechnical” included topics such as OCOH, strategic plans, personnel profiles, organizational restructuring, awards, and visiting officials. “Technical” articles were those that highlighted and emphasized the latest advances an organization is making/made in S&T, such as ongoing research, new discoveries, completion of successful testing, and achieved milestones. Given that the delineation between “feature article” and “technical” is somewhat imprecise, the data shown in Fig. 10 are intended to be viewed as a relative comparison among laboratories rather than absolute values. Further, it should be noted that the data shown in Fig. 10 are intended as a baseline, for informative purposes. The correct balance of “technical” versus “nontechnical” will depend on multiple factors, to include, but not limited to, available resources, priorities, and vision for each individual organization. Comparison to other organizations is one factor in determining the appropriate balance for ARL.

Nevertheless, as ARL pursues the vision to be a “premier laboratory”, ARL should emphasize and showcase the organization’s advances in S&T. Thus, the *TCWG recommends ARL increase the portion of ARL “technical” articles relative to “nontechnical”*. In general, ARL currently identifies topics for articles through weekly activity reports (WARs) and ad hoc contact from various principal investigators (PIs). ARL can build upon and improve this process by making a consistent, concerted effort in the following:

1. Campaigns and/or Directorates should take a more proactive role in working with PAO to identify key S&T advancements worthy of “technical” articles.
2. ARL first-author publications in reputable, high-profile, scientific journals (e.g., *Nature*, *Science*, *Advanced Materials*, *Small*) should trigger an “automatic” accompanying notification to PAO for a potential “technical” article.

It is important to note that timing the release of “technical” articles, as with other types of articles, can be critical. To have the greatest impact, the release of ARL’s articles should coincide with the completion of tests, publication of papers, and so on, as appropriate. This requires timely, *proactive* coordination and communication from Campaigns, Directorates, and/or PIs to ARL’s PAO. Release of such articles should also be coordinated with press releases from our university and business partners to adequately convey ARL’s role in various projects that may or may not be led by ARL.

2.2.2 Actively Distribute ARL Content into Popular Media

One of the most effective ways for scientific organizations to increase technical recognition to general audiences beyond DOD is to have a presence, particularly online, in scientific popular media, such as *Popular Science*, *Gizmodo*, and *MIT TechReview*. The *TCWG* recommends ARL pursue a more aggressive effort to push technical achievements into the popular media. ARL should target more than 4 placements in these types of outlets per year, which means that there should be at least a monthly “push” of an S&T piece out to relevant media beyond the DOD, assuming most pieces will not get picked up.

Media placements in these types of outlets, in the absence of existing relationships, typically takes place via a press release service. ARL currently uses *Cision* (www.cision.com),⁹ available through the US Army Research, Development and Engineering Command (RDECOM), to distribute articles to relevant outlets. Our study found that historically there was a very low use of this service (<2/year). While data from Cision are not currently available, data from ARL’s previous service (used up until at least May 2015), *EurekaAlert*, are shown in Fig. 11. It highlights the low number of articles ARL has historically “pushed” into popular media.

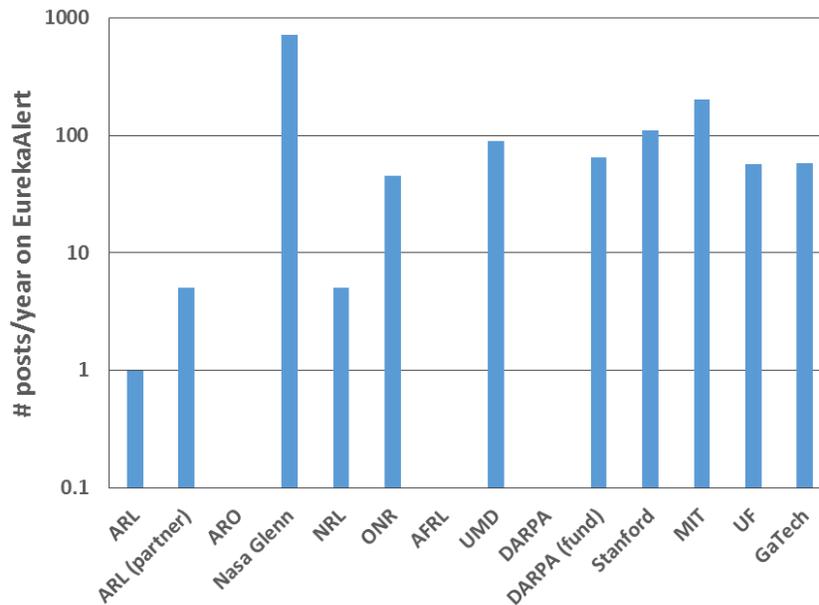


Fig. 8 The number of posts distributed on EurekaAlert during 2015 by various DOD, federal, and private laboratories.

Notes: ARO=Army Research Office, ONR=Office of Naval Research, UMD=University of Maryland, and UF=University of Florida

We concluded that the main impediment is that there is not a culture within ARL for pursuing this type of recognition. In the few cases where ARL was featured in one of these publications, it was due to a strong push from the PI. Currently, the frequency of releases to Cision is too low to evaluate its efficacy, so the initial recommendation is to simply increase the frequency of use.

Three actions should be taken to support this recommendation:

1. A policy to encourage PIs and PAO to pursue popular media should be circulated.
2. Campaigns and/or Directorates should take a more active role in identifying S&T achievements worthy of broader dissemination through Cision.
3. ARL first-author publications in reputable, high-profile, scientific journals (e.g., *Nature*, *Science*, *PNAS*, *Advanced Materials*, *Nano Letters*, etc.) automatically trigger notice to PAO because these articles are likely well suited for further dissemination through Cision.

2.3 Leveraging Established S&T Audiences

Our final recommendation for improving ARL's recognition beyond DOD involves leveraging existing science communicators to attract more traffic to our content. There are a number of online and traditional presences that communicate science to huge audiences, such as *Smarter Every Day* on YouTube, Science Friday on National Public Radio (NPR), TED Talks, or *IFLScience* on Facebook. *TCWG recommends that ARL actively engage these popular science communicators to leverage their audiences.* We believe that there is engaging technical content on the ARL website and social media. However, ARL's number of actively engaged participants on social media is still growing, and there is little "pull" for people to organically seek out information from ARL. As an example, ARL currently has 422 YouTube subscribers while *Smarter Every Day* boasts over 3.6M.

As an aside, the curator of the *Smarter Every Day* channel¹⁰ is Destin Sandlin, a Missile Flight Test Engineer working for the US Army Test & Evaluation Command at Redstone Arsenal, Huntsville, Alabama. Given his engineering background and connection to the Army, inviting him to do a video on ARL would be a great opportunity and a natural fit.

3. Prong 2: Improve Workforce Technical and Strategic Communications Skills

The working group recommends a 2-part approach for increasing the consistency of an ARL message across ARL research personnel: 1) the new positions for scientific leads for each of ARL Campaigns develop a bullet list of top-line strategic messages and supplemental bulleted list of supporting messages and 2) the ARL PAO (or equivalent) develop a monthly in-person 30-min seminar on how to convert a person's scientific research into a short brief that incorporates the strategic message for the work's associated ARL Campaign (with videos of these monthly seminars posted on the existing ARLInside events page: arlinside.arl.army.mil/inside/events). This 2-part approach is largely derived from the preparation provided for the DOD Lab Day at the Pentagon Center Courtyard in May 2015. As detailed in the following sections, the working group will collaborate with PAO to train the work force how to give bottom-line-up-front summaries, 2-min elevator pitches, and similar concise research descriptions to nontechnical audiences. Provide regular workshops on writing skills and public speaking.

3.1 Top-Line Strategic Messages

Each presenter at the Lab Day was provided a lanyard that included four 2.5- × 5-inch laminated cards, and the cards provided the critical strategic information for the event, including the onsite point of contact list, the schedule, the 3 bulleted ASA(ALT) key communication points, the 4 bulleted RDECOM top-line messages, and the 5 bulleted RDECOM supporting messages. These are known as troop cards in PAO. A snapshot of these lanyard cards provided in Fig. 12.

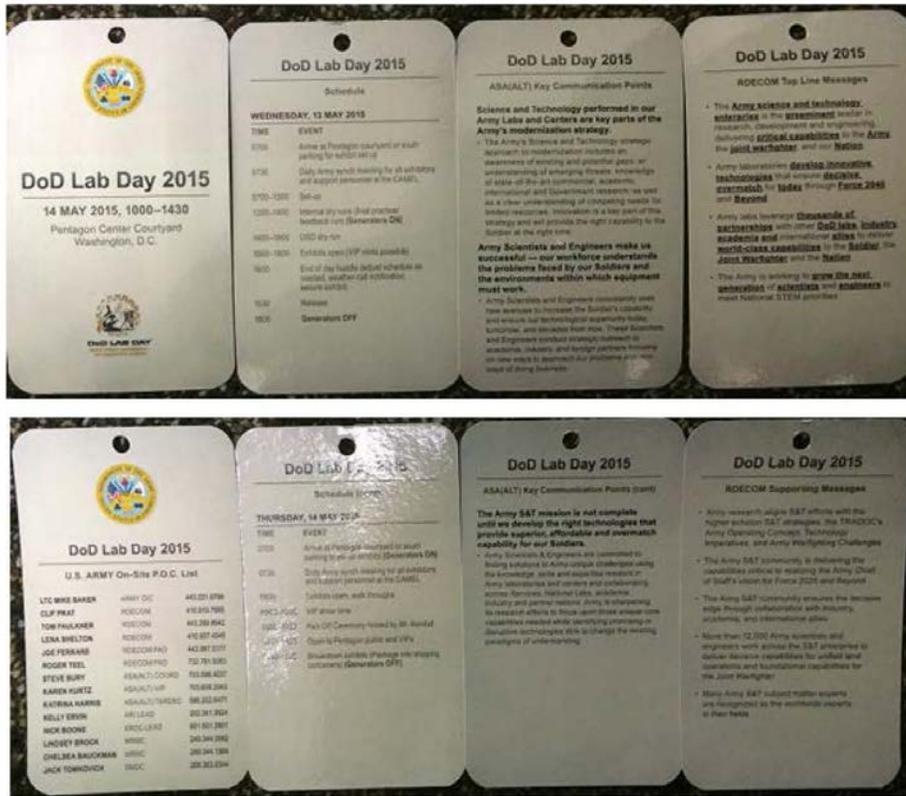


Fig. 9 Front and back sides of the 4 laminated cards provided on a lanyard to each DOD Lab Day participant in 2015 to provide references about the strategic message for the presenter’s demos

TCWG recommends that a similar messaging strategy be developed for each of the ARL Campaigns by the new campaign scientific lead positions slated for recruitment in calendar year 2016. By providing the top-line strategic messages of how the main research thrusts in each ARL Campaign relate to the strategic guidance (e.g., Army Warfighter Challenges or Big Army messaging), the researchers executing the work under each Campaign will more easily know how to provide a coherent message about the larger strategy that guides their work. This will clarify the message that researchers can articulate in briefs to VIPs or media interviews, but it can only be instilled via conference presentations and journal articles, thereby increasing the spread of ARL’s research aims that underlie each united scientific portfolio.

3.2 30-Min Training Workshops

Successful use of the top-line messages will likely require training to educate researchers on how to intertwine the message in a coherent and convincing manner, and all scientists benefit from practice in communicating the big picture message

about the relevance of their research, since it is easy to get lost in the implementation details. Thus, this working group recommends in-person workshops with 3 parts: a 10-min slide deck overview with general approaches and an example, 5 min for each attendee to draft a 2-min pitch, and 15 min for volunteers to practice and get feedback. The timing and frequency of these workshops is complicated, but one approach could be targeted sessions with particular campaigns or specific branches, in preparation for events like Program Formulation/OCOH, or on a semi-regular basis to fulfill an annual training requirement.

For the slide deck, a representative from ARL PAO (or equivalent level of training) would provide a short overview of the general process to create a coherent brief (2, 5, or 15 min are the most common for VIP visits in FY15). The seminar component could leverage content from the presentation given by Joe Ferrare from the RDECOM PAO to all DOD Lab Day presenters entitled, “Telling the Army S&T story: communicating with a lay audience” (see the Appendix). The remaining time in the workshop should be hands-on practice with both writing and presenting. This would allow burgeoning presenters to get needed feedback about the level of specificity in the technical content as well as how well the research is tied to the higher-level strategic message, either from the ARL Campaigns or ARL/RDECOM more generally.

4. Prong 3: Implement a Stakeholder Database

TCWG recommends implementing a stakeholder database, which would function in the same way as a customer relationship management system. The number of stakeholders or potential stakeholders for certain projects can be very high, making it likely that a degree of communication with those stakeholders will be lost. This database will address that problem by maintaining a list of stakeholders, their preferences, and a record of all communication with those stakeholders. This will result in improved communication, insights about the communication practices of stakeholders, more timely correspondence, and an overall improvement of stakeholder relations.

The database will contain names of people, organizations, and laboratories that are relevant to projects within ARL. The records contained in the database will help identify and notify potential stakeholders throughout the life of ARL projects, from brainstorming to program completion, and can include project execution and reporting. The frequency of technical communications will be unique to each stakeholder, and records of this communication will be stored with each individual stakeholder. Collecting information with the stakeholder database will also allow

custom queries to display tabular or graphical information about a wide array of engagement analytics. Using this database will allow specific communities of interest to share information and resources, and leverage existing and past work in a way that might otherwise be impossible given the wide array of disparate research areas in ARL.

The database will include a record for every stakeholder detailing contact information, a history of contact efforts, open opportunities, and achieved results. An example of a record and the information stored within a record is shown in Fig. 13. In the “Contacts” tab, communication efforts can be logged by anyone who reaches out to a stakeholder. The “Opportunities” tab will provide a way to track potential benefits from the interaction. The “Results” tab will provide a place to log the impact achieved as a result of strategic communication with this stakeholder. Information can be queried to provide analytics, automated reminders, awareness about opportunities that are going stale, and more. These queries and other features can be saved so they are accessible every time the user visits the database.

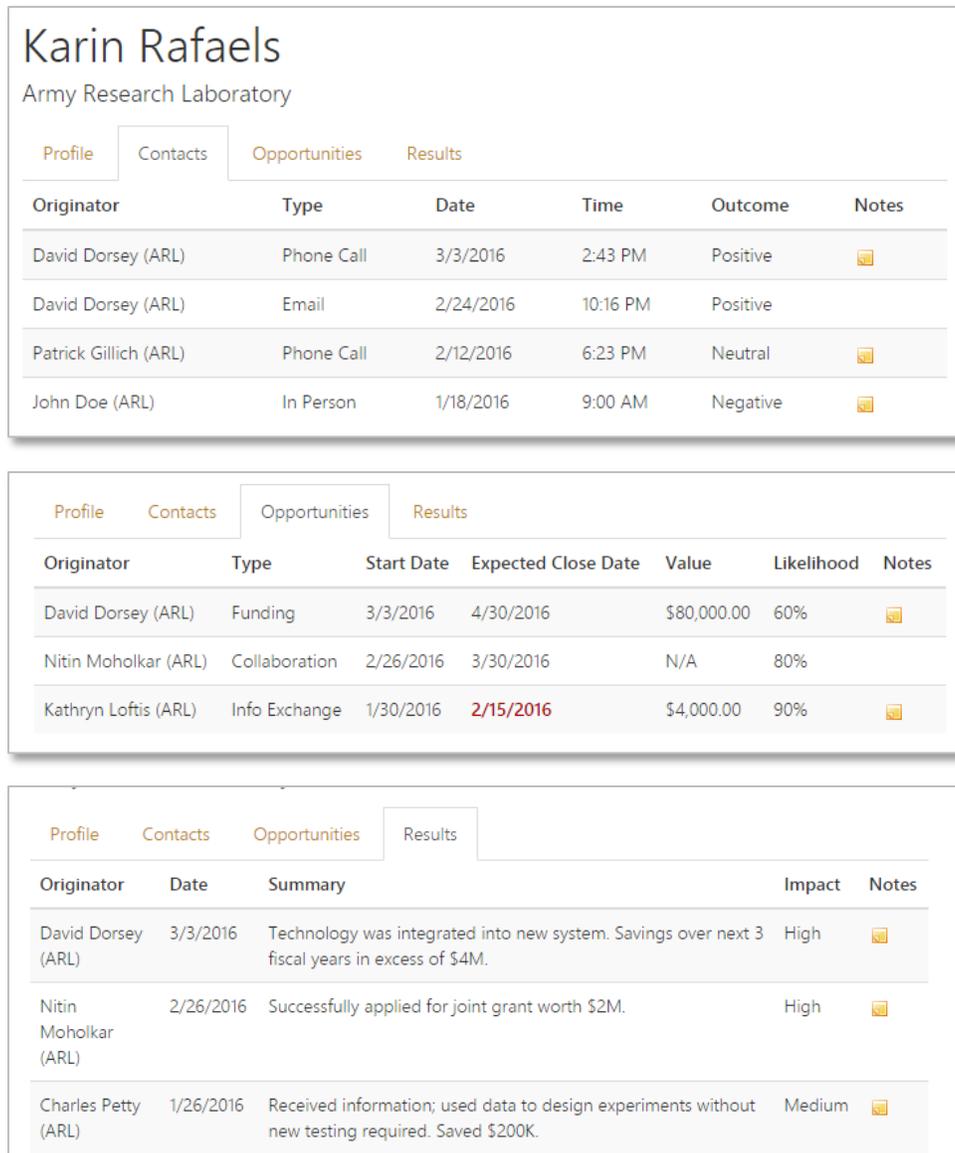


Fig. 13 Three screenshots from ARL’s Survivability/Lethality Analysis Directorate’s Collaboration Tools software. In the top panel, the Contacts tab allows individual researchers to create a list of contacts and log dates and details for each communication event. In the middle panel, the Opportunities tab allows individual researchers to maintain a list of opportunities that can be pursued with additional stakeholders. Finally, in the bottom panel, the Results tab allows individual researchers to generate a list of key results from their customer interactions.

The stakeholder communication can also be associated within a community of interest so stakeholder contacts, opportunities, and results can be shared within that community. The system is designed to support users outside of ARL and can support communities of interest throughout DOD, including stakeholder prospects in academia or in industry (though the system itself is only available to common

access card [CAC]-authenticated users on the DOD network). Documentation, data, and other information can be stored and accessed through this system as well, establishing a seamless path for a project from its infancy through the creation of a final report.

The application framework that will support this database already exists and is actively in use throughout ARL. For DOD employees and contractors, it can be accessed at <https://tools.arl.army.mil>, and the interface is shown in Fig. 14. The framework features a customizable dashboard that connects to an array of subapplications and provides a way for users to view information important to them at a glance. The system contains access control functionality so sensitive information can be restricted to protect need to know. Furthermore, the system exists on both Non-Secure Internet Protocol Router (NIPR) and Secure Internet Protocol Router (SIPR) to support classified data. To facilitate use, the unclassified summary information can be seen on NIPR so users are aware of what is available on SIPR without having to enter a classified environment.

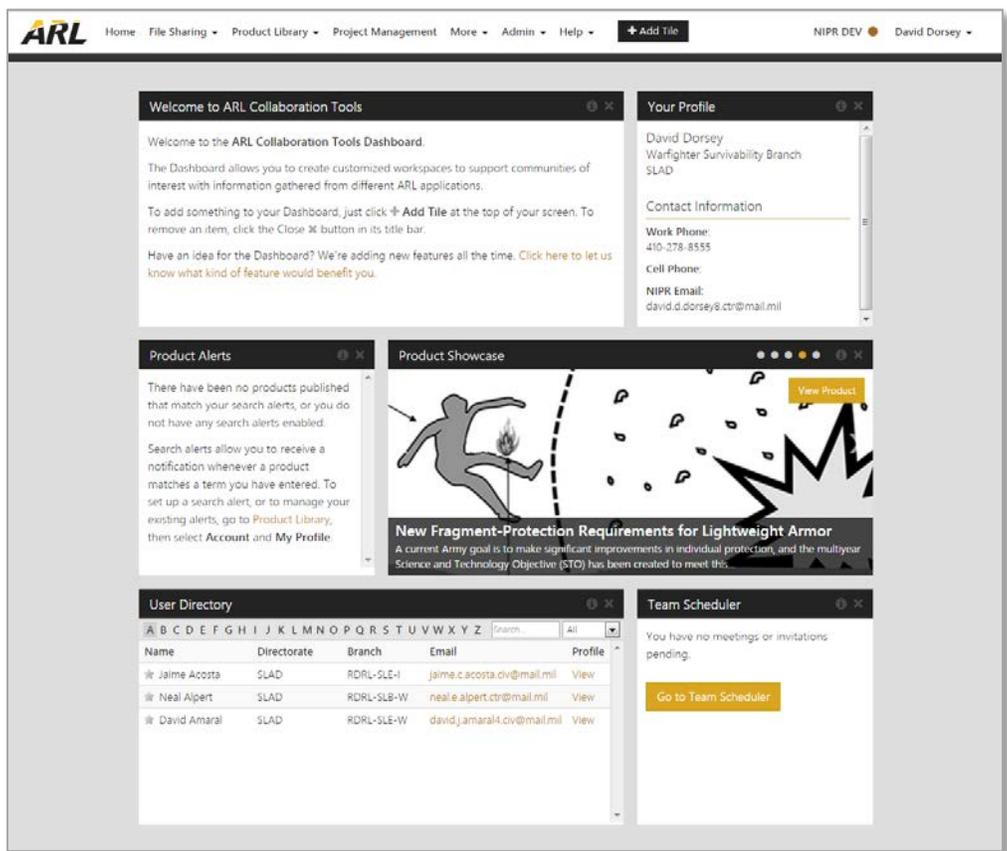


Fig. 14 Collaboration Tools provides an existing framework and database that can be leveraged for the rapid development of an application that can facilitate more effective strategic communication

The success of this system will rely on support and commitment from all levels of management, as demonstrated with OCOH. The system will not work if it is not uniformly and widely embraced. Therefore, proper training and accounting for the time and money required to maintain the system needs to be incorporated into the time and fiscal budget of a project. The workforce can be motivated to make full use of the system by including customer relationship management within personnel evaluations. The information stored in this database will help employees to demonstrate their accomplishments.

5. Conclusion

At the beginning of fiscal year 2016, TCWG was tasked with reviewing ARL's existing technical communication practices, evaluating their efficacy, and proposing an ARL technical communication strategy. The group researched many components of the current state of the art in technical communication both within and outside the laboratory, and a summary of several components of our research can be found in the Appendix to this report. From this research and several group discussions, TCWG recommends a 3-prong, near-term technical communication strategy for the laboratory.

The first prong recommends that ARL modernize our online communication strategy. We highlighted examples of peer institutions that showcase latest research and findings, and we recommend that a diverse sample of research groups here at ARL pilot complementary versions in collaboration with OPSEC and PAO. Since the content would be maintained by research personnel, TCWG recommends that the decision to create a website be left to the individual or team that the website describes. To complement these lab-centric websites, the external ARL website should incorporate keyword tagging and subscription capabilities to allow naïve viewers to navigate the website quickly to the technical topic of interest to them. This subscription capability integrates with our recommendation to increase the number of "ARL technical" articles that are timed in concert with publications in high-impact journals and/or completion of innovative research projects. We recommend a *proactive* coordination and communication from ARL Campaigns, Directorates, and/or PIs to ARL's PAO to identify the scientific progress that should be featured. These articles could then feed an explicit strategy to increase the use of Cision (www.cision.com),⁹ available through RDECOM, to distribute articles and make a more aggressive effort to push ARL technical achievements into the popular media. Finally, these S&T articles could also serve as a feeder to YouTube channels on S&T topics that already have an extensive audience for cutting-edge science. TCWG recommends that leveraging a YouTube channel such as *Smarter Every Day*¹⁰ that already has over 3.6M subscribers is more efficient

dissemination that trying to build subscriptions to ARL YouTube channel that current sits at 422 subscribers. In short, across our recommendations, TCWG encourages an online communication strategy that conveys the technical detail about ongoing accomplishments on websites to engage collaborators and potential employees, but it also actively shares the excitement about innovative ARL research and scientific accomplishments with the public and tech-savvy audiences through press releases and social media/YouTube subscriptions.

The second prong of our suggested strategy recommends in-house training to ensure ARL researchers are prepared to communicate a powerful and engaging scientific message in support of our first prong to enhance ARL's online, scientific presence. We suggest that ARL Campaigns create top-line strategic messages to capture the broad impact of the research to the Army and larger scientific community. Researchers can then incorporate the larger ARL message within their project-level descriptions of ongoing research. Furthermore, PAO or a group with similar communication expertise can offer short, 30-min training sessions to cultivate engaging research summaries for nonexperts. These training sessions could be scheduled with particular branches or research teams or could be offered more generally in preparation for events like Program Formulation or OCOH. In short, the second prong of our recommendation features in-house, staff development opportunities to ensure clarity in our scientific messaging.

Finally, the third prong in our near-term recommendation is a stakeholder database to better track communication and success stories with our customers. We highlighted an existing tool known as Collaboration Tools and available through the ARL website (<https://tools.arl.army.mil>). This website is accessible to internal and external researchers, and it provides a convenient way to track contacts, opportunities, and results. ARL researchers can then generate annual metrics for their performance review from this database, providing both a personal gain as well as strengthened ARL-customer relationships at the organizational level.

Across our 3-prong strategy, TCWG recommends a near-term focus that we expect to have the biggest return from existing capabilities and practices within the laboratory. We argue that ARL must continually evolve our technical communication strategies to enhance our mission. Benefits will include international recognition of ARL scientists, wider impact of ARL scientific accomplishments, easier recruitment of top-notch employees, attraction of more customer funding through strong demonstration of added value and enhanced tech transfer, and strengthened relationships with academic and industry collaborators. We recommend that future instantiations of this type of working group leverage the findings that we summarize in the appendices as they continue to suggest innovative ways to ensure ARL's international reputation as a premier laboratory.

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**Appendix. Support Material Compiled by the Technical
Communications Working Group (TCWG)**

This Appendix contains much of the data compiled by the Technical Communications Working Group (TCWG) to inform our discussions as well as meeting minutes from our group. The text in the main report may not contain additional nuanced findings or topics captured in these appendices, so we suggest that future instantiations of a technical communication committee use these materials as a reference for their novel analysis and subsequent recommendations.

A-1 Publications Data

To better understand how the US Army Research Laboratory's (ARL) publication record has evolved over time, we compiled data from ARL's Technical Library Database. The charts that follow (Figs. A-1 through A-5) show the number of refereed journals, books, presentations and proceedings, and technical reports published by ARL between the years 2002 and 2015.

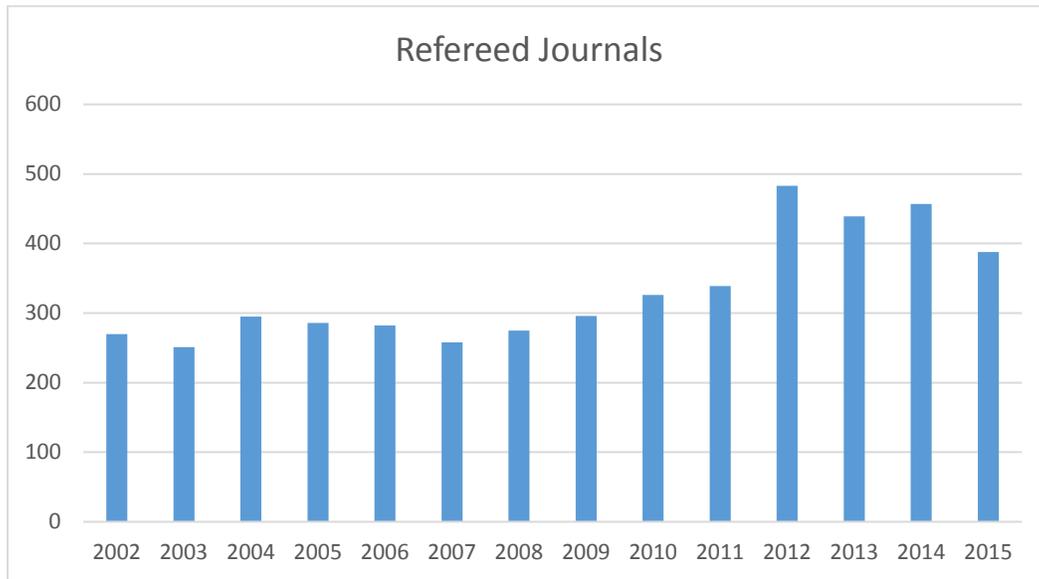


Fig. A-1 Number of refereed journal publications by year

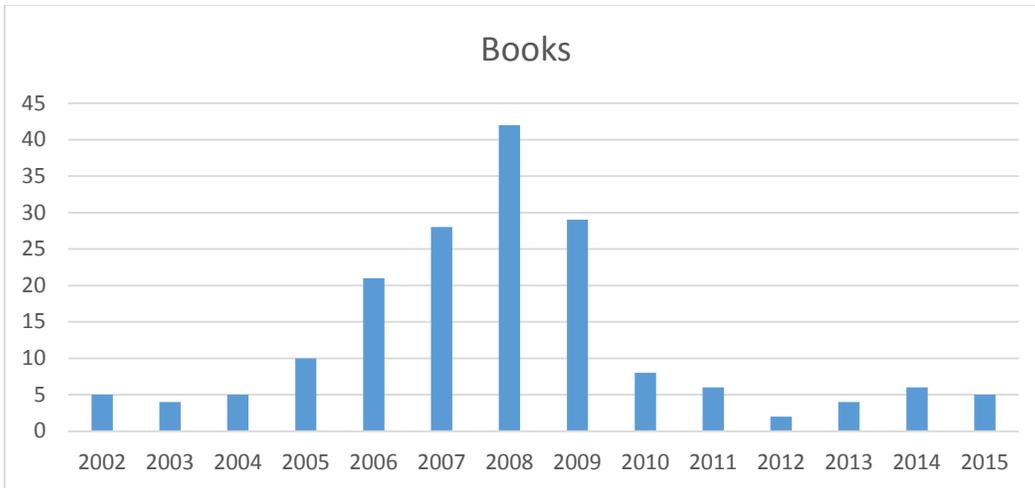


Fig. A-2 Number of books published by ARL by year

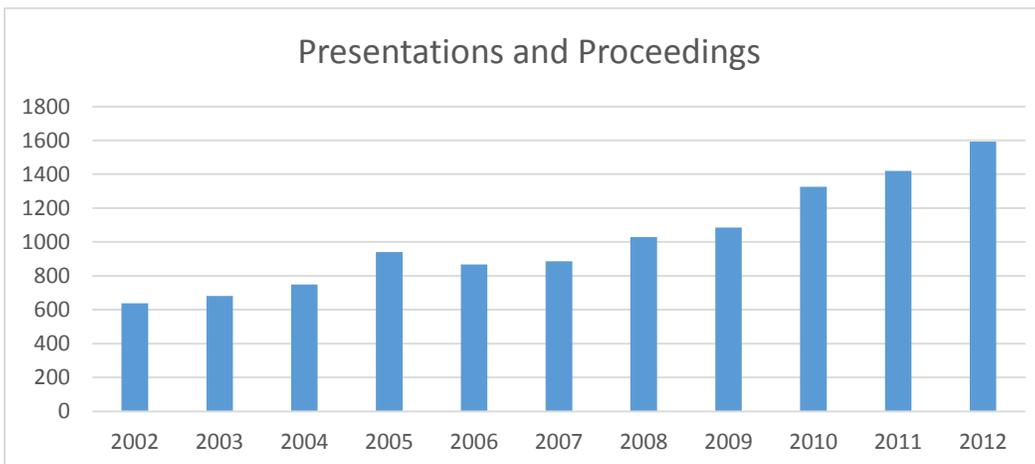


Fig. A-3 Number of conference presentations and proceedings published by ARL by year

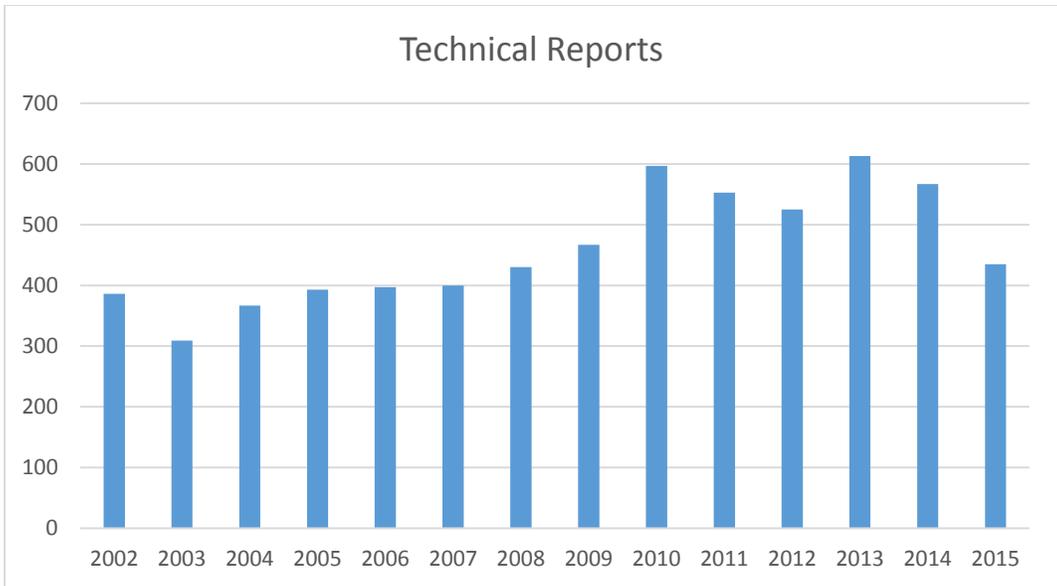


Fig. A-4 Number of technical reports published by ARL by year

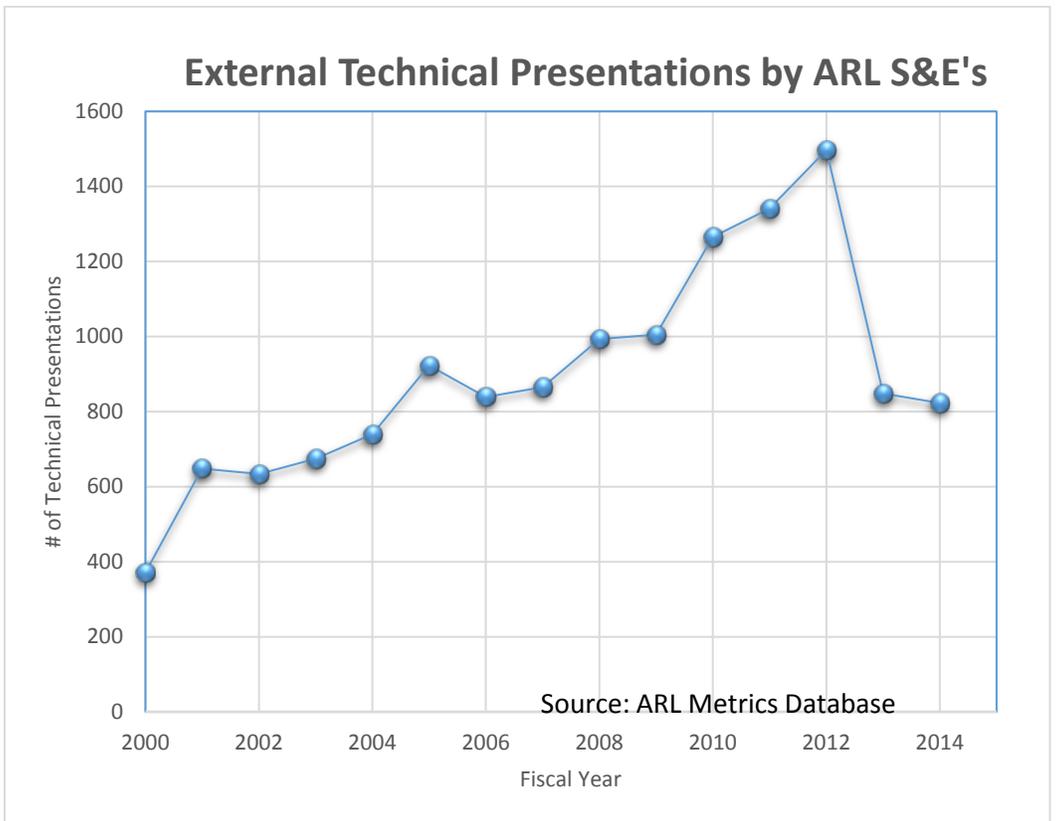


Fig. A-5 ARL technical presentations by year

A-2 Goals Matrix

Tables A-1 and A-2 were an initial effort by the group to clarify ARL communication goals and how they might be reached. In particular, we began by working to identify the various audiences that ARL seeks to target for communication. For each identified audience, we then asked what message ARL should attempt to convey to that audience, how that message should be conveyed to that audience, and how often it should be communicated. Finally, we sought to identify the ultimate outcome that ARL desires as a result of communicating those messages to those audience. The resulting goals matrix is shown in Table A-1. After clearly identifying the goals of the work, we began to assess the potential risks and rewards of such engagements. This included estimating the level of resources needed, resources available, cost, initial effort required, long term effort required, and impact of the activity. This assessment is shown in Table A-2.

Table A-1 Goals matrix

Audience	Message	How we should convey message	How often should we convey the message	Desired outcomes
Public community/ science, technology, engineering, and mathematics (STEM) Outreach	The leaders and citizens who will meet challenges of tomorrow are in school today and should learn about the lab and the cool research happening here.	Museum exhibits, frequent public media exhibitions, website, local news, community organization, STEM-related, activities (FIRST, Scouts, Citizen School), videos	Permanent exhibit at a museum, quarterly for media, annual for STEM	Increase national public awareness of our lab.
Stakeholders (AMC, RDECs, ASA(ALT), TRADOC, Warfighter, other Federal stakeholders)	We are a diverse, highly skilled organization prepared to tackle the future Army's problems.	Targeted publications, WAR type email summary, CAC-only FOUO website, OCOH, home on homes, community of practices, videos	Monthly?	Increase awareness of our capabilities.
Academia and other federal research agencies, recruitment	Share information and provide research updates.	Science meetings, OCOH, website, journals, home on homes, videos	Quarterly	Leverage current research and further develop collaboration.
Industry	Improve communication and feedback to help industry understand strategies, objectives, requirements, and priorities.	Through project-focused meetings and at association symposia and conferences, articles on website, articles in technical trade magazines, SBIR/STTR calls, videos	Meetings should occur around acquisition events where there is still time to influence the decisions (biannually?).	Align near- and long-term investment decisions and avoid uncoordinated efforts.
Coworkers/Internal ARL	Internal ARL collaboration can solve many research problems.	Through a searchable tool	To new employees initially and throughout the year.	Reduce need to go out and find a tool or expertise, reduce cost, reduce time to perform research.
Recruitment	ARL is a great place to work. ARL leads the research field.	Great research, website, videos	When interacting with potential post docs; students; professors; partners	Attract higher quality postdocs; improve ARL staff morale and retention.

Note: AMC=Army Materiel Command, RDECs=Research and Development Centers, SBIR=Small Business Innovation Research, STTR=SBIR Technology Transfer Research.

Table A-2 Risk assessment

		Resources needed	Resources already available	Cost	Initial effort	Long- term effort	Impact
Public community outreach	Museum exhibits	M	M	M	H	L	L
	Frequent public media exhibitions	M	M	M	M	M	L
	Website	L	H	M	H	M	H
	Local news	L	M	L	H	M	L
	Community organization	L	L	L	M	M	L
	STEM-related activities	M	M	M	L	L	L
	Videos	M	M	L	H	H	L
Stakeholders	Targeted publications	M	M	M	H	M	M
	WAR-type email summary	L	H	L	L	L	M
	CAC-enabled FOUO website	M	L	L	H	M	M
	OCOH	L	H	M	H	M	L
	Home-on-homes	L	H	L	M	M	H
	Community of practices						
	Videos	M	M	L	H	H	L
Academia and other Federal research agencies, recruitment	Science meetings						
		M	H	M	H	M	H
	OCOH	L	H	M	H	M	L
	Website	L	H	M	H	M	H
	Journal publications	L	H	L	L	L	H
	Home-on-homes	L	H	L	M	M	H
Videos	M	M	L	H	H	L	

Table A-2 Risk assessment (continued)

		Resources needed	Resources already available	Cost	Initial effort	Long- term effort	Impact
Industry	Project-focused meetings	M	M	M	H	M	H
	Association symposia and conferences	L	H	M	L	L	H
	Articles on website	L	H	M	H	M	H
	Articles in technical trade magazines	L	H	L	L	L	H
	SBIR/STTR calls						
	Videos	M	M	L	H	H	L
Coworkers / internal ARL	Through a searchable tool	H	M	M	H	M	H
Recruitment	Great research	M	H	H	H	H	H
	Website	L	H	M	H	M	H
	Videos	M	M	L	H	H	L

We had the following other thoughts and ideas:

- Oral communication is a particularly effective medium for the transfer of information—permits rapid feedback, recoding, and synthesis of complex information; more current and efficient than formal information media.
- Perhaps create a public engagement database with names of people, organizations, or laboratories that the researchers would like to have informed of their work.
- Perhaps create a newsletter or publication that contains general interest summaries of any refereed journal paper (summaries could be submitted to Public Affairs Office [PAO] during Form 1 process).
- Get customers to promote us.

A-3 YouTube Data

One popular method identified for communicating to a broader audience is by posting videos on YouTube. To provide a sense for ARL’s YouTube presence relative to other institutions, we compiled data on the subject. In particular, we examined the number of posts in the past 12 months, the number of hits for the most popular posting, the number of posts with more than 10,000 hits, and the number of subscribers to the channel. We compiled this data for several well-known research universities: Caltech, Massachusetts Institute of Technology (MIT), the University of Maryland (UMD), and Stanford; and national laboratories: MIT Lincoln Lab (LL), Sandia National Labs (SNL), Oak Ridge National Lab (ORNL), Johns Hopkins University Applied Physics Lab (JHU APL), National Aeronautics and Space Administration’s (NASA) Jet Propulsion Lab (JPL), US Naval Research Laboratory (NRL), and ARL. The results of this study appear in Table A-3 and Figs. A-6 through A-9. Note that searches for “NRL” and “ARL” did not return results commensurate with NRL and ARL, respectively. The full unabbreviated versions were required to find the appropriate YouTube Channels, which could be a problem.

Table A-3 YouTube data for various research universities and NLS

Entity	Posts this year	Most Hits	Less than 10k hits	Subscribers
Stanford	433	23000000	488	480000
MIT	60	7000000	150	112000
Caltech	100	250000	40	25000
UMD	52	40000	5	1790
JPL	77	3800000	384	160000
JHU APL	20	2700000	7	4300
SNL	23	1100000	20	3000
NRL	4	380000	6	1286
ORNL	38	47000	8	1800
ARL	17	9000	0	378
MIT LL	0	0	0	0

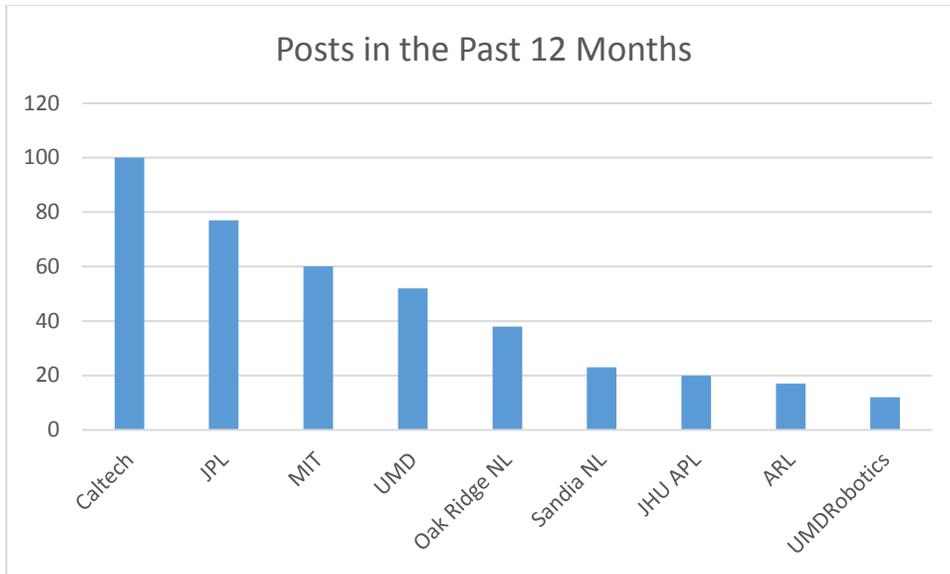


Fig. A-6 Number of videos various research institutions have posted to YouTube

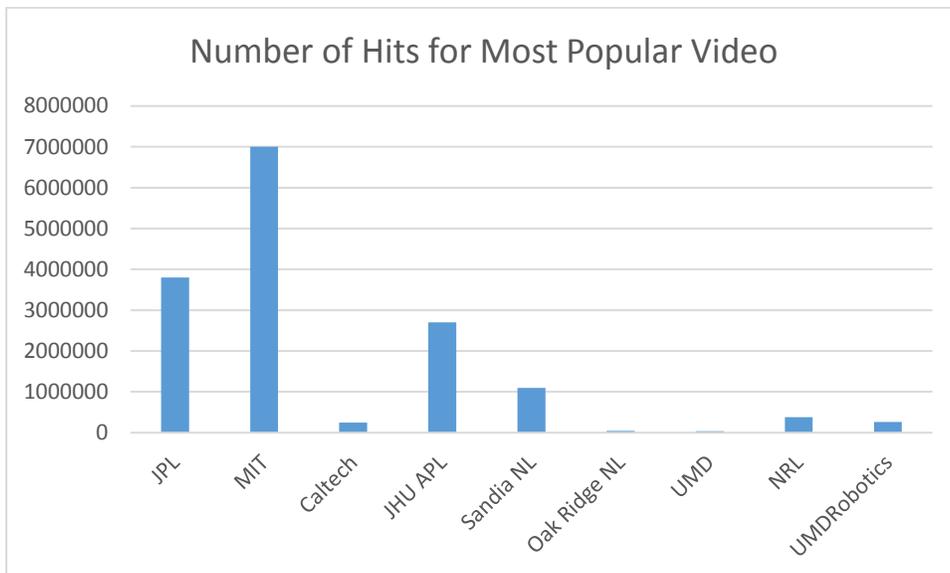


Fig. A-7 Number of hits for the most popular YouTube post for various research institutions

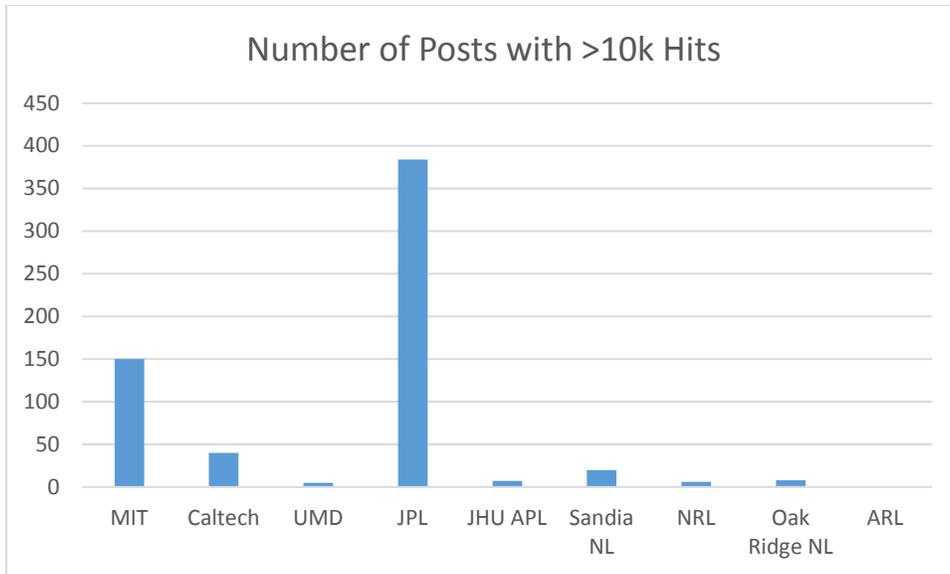


Fig. A-8 Number of YouTube posts with more than 10,000 hits for various research institutions

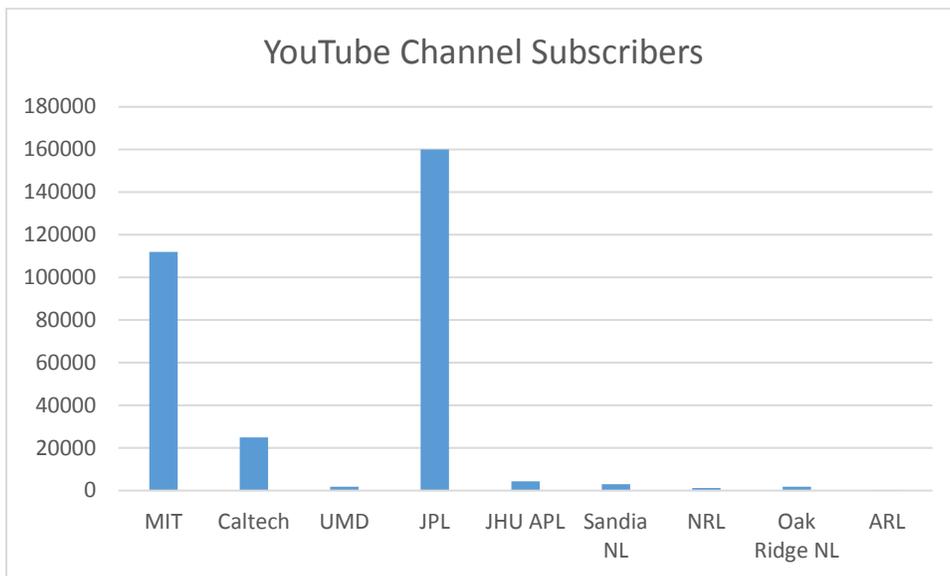


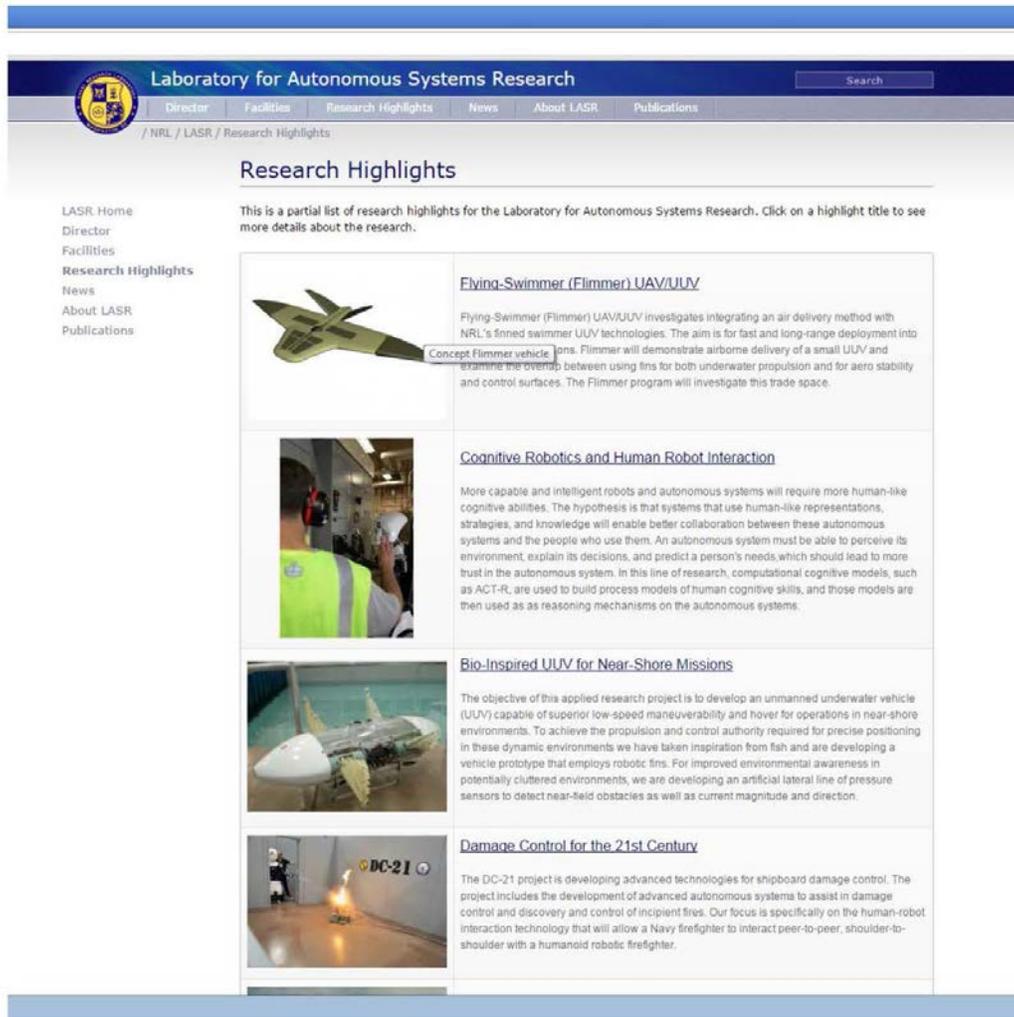
Fig. A-9 Number of subscribers to the YouTube channels of various research institutions

A-4 Laboratory Website Examples

One common means of communicating to a broad range of audiences is through the laboratory's official website. As such, we surveyed the websites of several other research institutions. The images that follow show representative snapshots of how other institutions present themselves through their official websites.

A-4.1 Laboratory for Autonomous Systems Research, NRL

Figures A-10 through A-12 show images from NRL's Laboratory for Autonomous Systems Research website (<http://www.nrl.navy.mil/lasr/>).



The screenshot displays the Laboratory for Autonomous Systems Research website. The header includes the NRL logo, the title "Laboratory for Autonomous Systems Research", and a search bar. Below the header is a navigation menu with links for "Director", "Facilities", "Research Highlights", "News", "About LASR", and "Publications". The main content area is titled "Research Highlights" and contains a list of four research projects, each with a small image and a brief description.

Research Highlights

This is a partial list of research highlights for the Laboratory for Autonomous Systems Research. Click on a highlight title to see more details about the research.

- Flying-Swimmer (Flimmer) UAV/UUV**
Flying-Swimmer (Flimmer) UAV/UUV investigates integrating an air delivery method with NRL's finned swimmer UUV technologies. The aim is for fast and long-range deployment into UUVs. Flimmer will demonstrate airborne delivery of a small UUV and examine the tradeoffs between using fins for both underwater propulsion and for aero stability and control surfaces. The Flimmer program will investigate this trade space.
- Cognitive Robotics and Human Robot Interaction**
More capable and intelligent robots and autonomous systems will require more human-like cognitive abilities. The hypothesis is that systems that use human-like representations, strategies, and knowledge will enable better collaboration between these autonomous systems and the people who use them. An autonomous system must be able to perceive its environment, explain its decisions, and predict a person's needs, which should lead to more trust in the autonomous system. In this line of research, computational cognitive models, such as ACT-R, are used to build process models of human cognitive skills, and those models are then used as reasoning mechanisms on the autonomous systems.
- Bio-Inspired UUV for Near-Shore Missions**
The objective of this applied research project is to develop an unmanned underwater vehicle (UUV) capable of superior low-speed maneuverability and hover for operations in near-shore environments. To achieve the propulsion and control authority required for precise positioning in these dynamic environments we have taken inspiration from fish and are developing a vehicle prototype that employs robotic fins. For improved environmental awareness in potentially cluttered environments, we are developing an artificial lateral line of pressure sensors to detect near-field obstacles as well as current magnitude and direction.
- Damage Control for the 21st Century**
The DC-21 project is developing advanced technologies for shipboard damage control. The project includes the development of advanced autonomous systems to assist in damage control and discovery and control of incipient fires. Our focus is specifically on the human-robot interaction technology that will allow a Navy firefighter to interact peer-to-peer, shoulder-to-shoulder with a humanoid robotic firefighter.

Fig. A-10 NRL research highlights¹

¹US Naval Research Laboratory webpage. Washington (DC): NRL; n.d. [accessed 2016]. <https://www.nrl.navy.mil/lasr/>.

swimmer-flimmer-uavuuu

Laboratory for Autonomous Systems Research
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Cognitive Robotics & HRI

Bio-Inspired UUV for Near-Shore Missions

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Ion Tiger Fuel Cell Powered UAV

Mobile Autonomous Teams for Information Surveillance & Search

Adaptive Testing of Autonomous Systems

Processing and Characterization of Lithium-ion Batteries

Hydrogen Fuel Cell Stack and Systems

Predicting and Preventing Errors

Goal Reasoning

[Robotic Touch Sensing, Manipulation, and Fault Detection](#)

Swarm Control using Physicomimetics

News

About LASR

Publications

NRL is merging two separate research areas — unmanned undersea vehicles (UUVs) and unmanned air vehicles (UAVs) — to significantly improve tactical availability of UUVs in time critical situations. Common across the services, autonomous vehicles are being seen as an effective projection of force, both above and below the water's surface. Unlike an air-deployed Sonobuoy, ongoing research into novel bio-inspired UUV finned propulsion has potential benefits for autonomous motion beyond the insertion point. This combination of an airplane mode for UUV insertion is the thrust of the Flimmer program.

UUV emplacement speeds are slow when long duration is required whereas UAV speeds are relatively fast and efficient. A flying emplacement is also not affected by high sea currents, opening the options for difficult-to-access areas.



Flimmer flight and splashdown

With NRL's investigation into flapping pectoral fins for underwater propulsion, the question arises if these same fins can be used for aerodynamic control surfaces. The aero and hydrodynamics can be modeled similarly, making it possible to understand the optimization trade space for fin function in the two media. Initial experiments will equip the existing NRL swimming UUV with folding wings. The lessons learned will feed into a more optimized configuration, aided by CFD studies to rework specific fin issues such as handling landing loads.

The project is developing flying UUV techniques and technologies for long-range air delivery of UUVs and investigating configurations for mixed-mode use of bio-inspired fins in both water and air environments.



Concept Flimmer vehicle

Principal Investigator:
Dr. Dan Edwards
Vehicle Research Section
Tactical Electronic Warfare
Naval Research Laboratory
drs@nrl.navy.mil

Publication Approval: 13-1231-2845

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Fault-detection			About the Area	Director of Research		

Fig. A-11 NRL project page¹

Laboratory for Autonomous Systems Research

/ NRL / LASR / Publications

Publications

→ [Search](#)

Title Type [Year ▼] Export 140 results: [BibTex](#)

2013

M. Pickett, Aha, D. W. , and J Trafton, G. , "[Acquiring user models to test automated assistants](#)", in *Florida Artificial Intelligence Research Society Conference*, St. Pete Beach, FL, 2013. [BibTex](#)

J. G. Trafton, Hiatt, L. M. , Harrison, A. M. , Tamborello, F. , Khemlani, S. S. , and Schultz, A. C. , "[ACT-R/E: An Embodied Cognitive Architecture for Human Robot Interaction](#)", *Journal of Human-Robot Interaction*, vol. 2, no. 1, pp. 30-55, 2013. [BibTex](#)

D. Gartenberg, Breslow, L. A. , Park, J. , McCurry, M. J. , and Trafton, J. G. , "[Adaptive automation and cue invocation: the effect of cue timing on operator error](#)", in *CHI*, Paris, France, 2013. [BibTex](#)

U. Jaldee, Muñoz-Avila, H. , and Aha, D. W. , "[Case-based goal-driven coordination of multiple learning agents](#)", in *International Conference on Case-Based Reasoning*, Saratoga Springs, NY, 2013. [BibTex](#)

C. Netwall, Gould, B. D. , Rodgers, J. A. , Nasello, N. J. , and Swider-Lyons, K. E. , "[Decreasing contact resistance in proton exchange membrane fuel cells with metal bipolar plates](#)", *Journal of Power Sources*, vol. 227, pp. 137-144, 2013. [BibTex](#)

S. S. Khemlani and Trafton, J. G. , "[Deduction as stochastic simulation](#)", in *ICCM*, Ottawa, Canada, 2013. [BibTex](#)

M. Wilson, Molineaux, M. , and Aha, D. W. , "[Domain-independent heuristics for goal formulation](#)", *Proceedings of the Twenty-sixth Florida Artificial Intelligence Research Society Conference*. AAAI Press, St. Pete Beach, FL, pp. 160-165, 2013. [BibTex](#)

M. Klenk, Molineaux, M. , and Aha, D. W. , "[Goal-Driven Autonomy for Responding to Unexpected Events in Strategy Simulations](#)", *Computational Intelligence*, vol. 29, no. 2, pp. 187-206, 2013. [BibTex](#)

C. Heltmeyer, Pickett, M. , Breslow, L. , Aha, D. W. , J Trafton, G. , and Leonard, E. I. , "[High assurance human-centric decision systems](#)", in *ICSE-13 Workshop on Realizing Artificial Intelligence Synergies in Software Engineering*, San Francisco, CA, 2013. [BibTex](#)

E. Martinson, Lawson, W. , and Trafton, J. G. , "[Identifying people with soft-biometrics at fleet week](#)", in *Proceedings of the 8th ACM/IEEE International conference on Human-robot interaction*, Piscataway, NJ, USA, 2013. [BibTex](#)

L. K. McDowell and Aha, D. W. , "[Labels or attributes? Rethinking the neighbors for collective classification in sparsely-labeled networks](#)", in *International Conference on Information and Knowledge Management*, San Francisco, CA, 2013. [BibTex](#)

K. E. Swider-Lyons, Stroman, R. G. , Rodgers, J. A. , Edwards, D. , MacKrell, J. A. , Schuette, M. W. , and Page, G. S. , "[Liquid hydrogen fuel system for small unmanned air vehicles](#)", in *Proceedings of 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition 2013*, Grapevine, TX, 2013. [BibTex](#)

F. Tamborello and Gregory Trafton, J. , "[A Long-Term Memory Competitive Process Model of a Common Procedural Error, Part II: Working Memory Load and Capacity](#)", *ICCM*. ICCM, Ottawa, Canada, 2013. [BibTex](#)

J. Geder, Ramamurti, R. , Pruessner, M. , and Palmisano, J. S. , "[Maneuvering performance of a four-fin bio-inspired UAV](#)", *OCEANS '13 Conference*. San Diego, CA, 2013. [BibTex](#)

L. M. Hiatt and Trafton, J. G. , "[The Role of Familiarity, Priming and Perception in Similarity Judgments](#)", in *Proceedings of the 35th Annual Meeting of the Cognitive Science Society*, Berlin, Germany, 2013. [BibTex](#)

M. Pickett and Aha, D. W. , "[Spontaneous analogy by playacting on a perceptual system](#)", in *Annual Conference of the Cognitive Science Society*. Berlin, Germany, 2013. [BibTex](#)

Fig. A-12 NRL publications page¹

A-4.2 MIT Lincoln Laboratory

Figures A-13 through A-15 show images from the MIT LL website (<http://www.ll.mit.edu>).² Note: One can see group-level research about as well as on ARL's website.

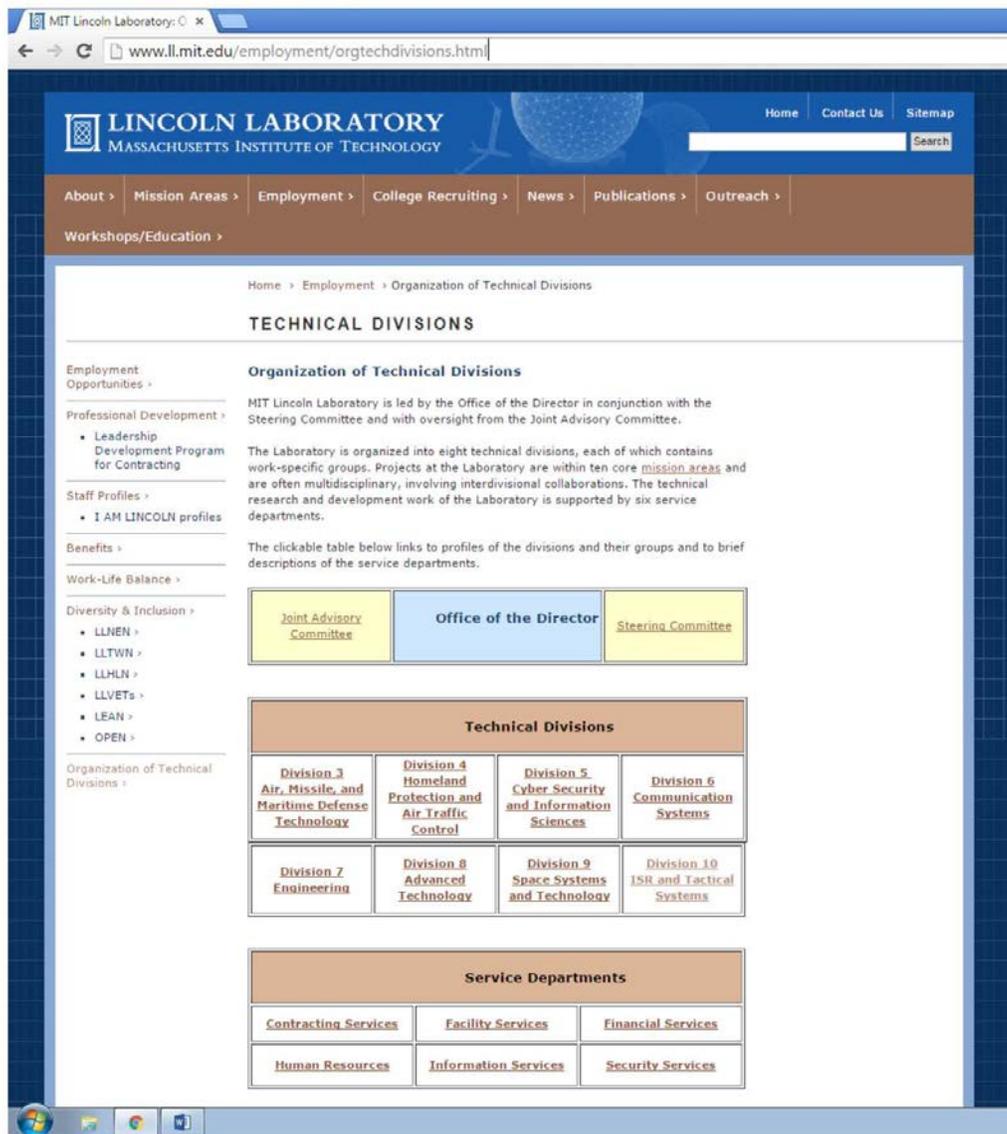


Fig. A-13 MIT LL organization page (reproduced with permission)²

² Lincoln Laboratory webpage. Lexington (MA): Massachusetts Institute of Technology; 2016 [accessed 2016]. <http://www.ll.mit.edu/>.



Fig. A-14 MIT LL technical division page (reproduced with permission)²

Figure 15 shows some research highlights with publications and code available.



Fig. A-15 MIT LL project information (reproduced with permission)²

A-4.3 Sandia National Labs (SNL)

Figures A-16 through A-18 shows images from the SNL's website. (<http://www.sandia.gov/>).³ Through their site, one can access project-specific pages with YouTube videos.

Sandia National Labs

<http://www.sandia.gov/>

Can access project-specific pages with YouTube videos

The screenshot shows the Sandia National Labs website with a blue header bar. Below the header, there are three navigation tabs: "ABOUT ROBOTICS", "RESEARCH & DEVELOPMENT", and "FACILITIES". The "ABOUT ROBOTICS" tab is active, displaying a list of seven categories with brief descriptions:

- Advanced Controls**: We specialize in the development of advanced control technology that enables a range of applications, from the control of multiple heterogeneous unmanned systems by one operator, to the control of a swarm of robotic platforms operating toward a common goal.
- Advanced Manipulation**: We have a long history of automating robots for difficult manipulation tasks. Leveraging Sandia-developed sensor technologies to locate objects in the environment, coupled with automated motion planners and force sensing and control technologies has enabled the development of advanced robot manipulators that can move to desired locations, perform safe interactions with hazardous materials, and can even perform fine manipulation tasks such as opening doors and performing surgery.
- Unique Mobility**: With expertise in mechanical design and fabrication, video and vision processing, communications systems, embedded computing, control, and navigation, we develop advanced mobility systems that are able to overcome a variety of obstacles and terrains, and are used for a variety of tasks including surveillance and reconnaissance, autonomous exterior/interior intrusion detection, de-mining, Improvised Explosive Device (IED) disablement, and accident response.
- Perception and Decision Tools**: We specialize in the development of advanced perception technologies and decision tools that enable robotic and unmanned systems to perform more complex and autonomous tasks, such as the automated mapping of a building. Our perception capabilities include 3-D geometric modeling and texture mapping, 3-D video motion detection, Simultaneous Localization and Mapping (SLAM), and augmented reality training.
- Cybernetics**: Leveraging Sandia's expertise in materials science, microsystems, and advanced modeling and simulation, we design and develop advanced cybernetic technologies for a variety of applications. Cybernetics includes the development of mechanical, physical, biological, and cognitive systems that enable advanced man-machine interface technologies.
- High-Consequence Automation**: We're the leader in developing cost-effective, reliable, automated systems to handle materials used in conventional and nuclear weapons. Applications range from flexible systems for automated disassembly of outdated munitions to systems for the destruction of hazardous waste.

On the right side of the page, there are three sections:

- Contact Us**: Questions and comments about High Consequence, Automation, & Robotics? [Contact us.](#)
- Image Gallery**:  [Visit Robotics' Image Gallery.](#)
- In the News**:
 - [Sandia hosts annual Robot Rodeo](#)
 - [Lifelike, cost-effective robotic Sandia Hand can disable IEDs](#)
 - [Sandia hopping robots to bolster troop capabilities](#)
 - [Sandia's self-guided bullet prototype can hit target a mile away](#)
- Publications & Factsheets**: [View all Robotics' publications and factsheets](#)

At the bottom right, there is a circular logo for the High-Consequence Automation Program, featuring an eagle and the text "HIGH-CONSEQUENCE AUTOMATION PROGRAM" and "SANDIA NATIONAL LABORATORIES".

Fig. A-16 SNL group page³

³ Sandia National Laboratories webpage. Albuquerque (NM): Sandia National Laboratories; 2016 [accessed 2016]. <http://www.sandia.gov/>

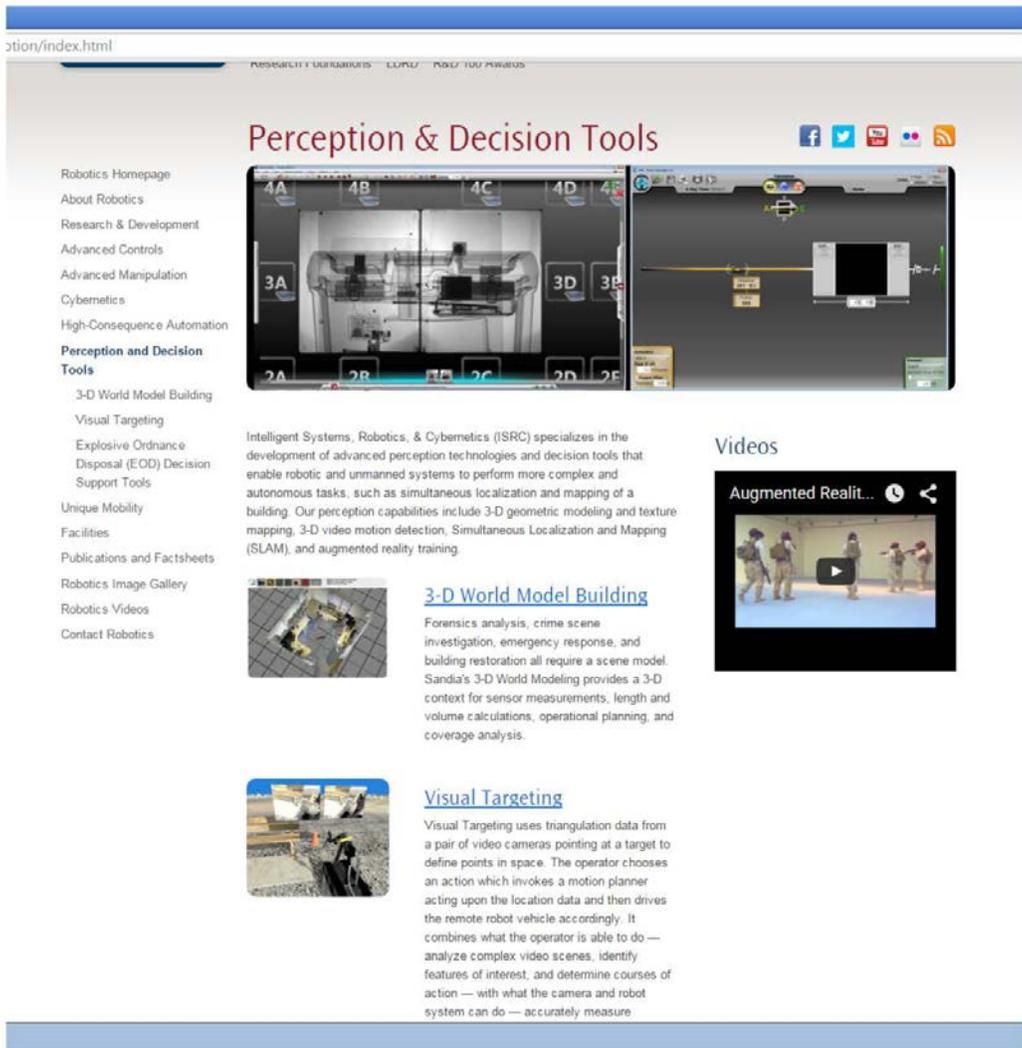


Fig. A-17 SNL project page³

ction/3d_world_modeling_building.html

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Technical Challenge

Our goal was to create an immersive, texture rich 3-D model within minutes of entering a room using nothing more than a laptop and a consumer color and depth camera (e.g., the Microsoft Kinect & ASUS sensor). The sensor generates a noisy cloud of 300 thousand 3-D points thirty times per second which must be converted into a textured polygonal mesh and correlated with prior readings. The interface needs to be quick, simple, and interactive so that rapid model building becomes a standard tool in the investigator's toolkit.



Videos



Need

Forensics analysis, crime scene investigation, emergency response, and building restoration all require a scene model. The model provides a 3-D context for sensor measurements, length and volume calculations, operational planning, and coverage analysis. In the past, models were derived from simple floor plans or created using simple sketch-up tools but these lacked the visual detail needed to properly describe a room. Three-dimensional survey equipment is available but the equipment is extremely expensive and the time required to generate a model is prohibitive. Our goal is to develop technology so that every response team can afford the equipment and be able to generate models without requiring a special modeling team.

Features & Benefits

The ASUS/Kinect sensor is less than \$200 and provides positioning accuracy within centimeters. The software can be deployed on any laptop with a high-end graphics card. A room can be modeled within a few minutes. Because of the speed and low cost of acquisition, models can be



Fig. A-18 SNL research page³

A-4.4 Oak Ridge National Laboratory (ORNL)

Figures A-19 through A-23 show images from the ORNL website (<https://www.ornl.gov/>).⁴ The site contains organizational charts, research group pages, researcher contact page, publications list, job opportunities, and so on.

Oak Ridge National Laboratory

<https://www.ornl.gov/>

Org charts, research group pages, researcher contact page, publications list, job opportunities, etc.

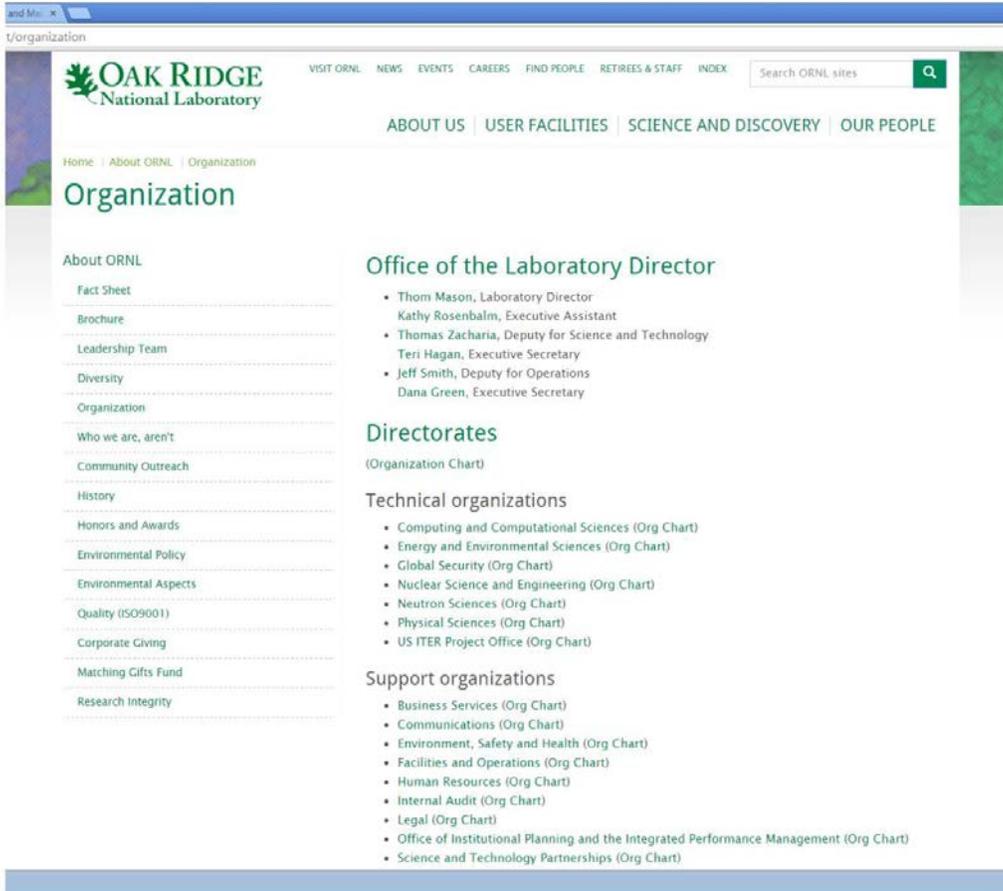


Fig. A-19 ORNL organization page⁴

⁴ Oak Ridge National Laboratory webpage. Oak Ridge (TN): Oak Ridge National Laboratory; n.d. [accessed 2016]. <https://www.ornl.gov/>.

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Welcome (site under construction some links may not work)

Imaging, Signals, and Machine Learning (ISML) is a research and development (R&D) group in the Electrical and Electronics Systems Research (EESR) Division of the Oak Ridge National Laboratory (ORNL). The group consists of fourteen full-time researchers with Electrical, Computer, and Mechanical Engineering backgrounds plus university students, faculty, and industry partners. We develop unique imaging computational imaging solutions and conduct applied computer vision research and development addressing important issues of industrial and economic competitiveness, biomedical measurement science, and national security.

Please feel free to use the navigation provided at this site to explore the research and development activities that are currently ongoing here at ORNL.

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[Dr. Trent Nichols and April McMillan receive the Community Outreach by a Team award](#)

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November 2012

[Dr. Chris Boehnen receives ORNL's Science & Technology —Early Career Award](#)

September 2012

[Artemis Magazine Article](#)

April 2012

[ISML Group Book Chapter in *Medical Imaging* edited by Okeschuken Felix Erundu released online](#)

June 2011

[ISML Iris Project Highlighted on Page 3 in the Energy and Environmental Sciences Quaterly Newsletter](#)

September 2010

Fig. A-20 ORNL group page⁴

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[September 2012](#)
Artemis Magazine Article

[April 2012](#)
[ISML Group Book Chapter in Medical Imaging edited by Okechukwu Felix Erondu released online](#)

[June 2011](#)
[ISML Iris Project Highlighted on Page 3 in the Energy and Environmental Sciences Quaterly Newsletter](#)

[September 2010](#)

Fig. A-21 ORNL team page⁴

ications.shtml

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National Safeguards and Security
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Publications

(**Bold** denotes ISML Group members [present or former], post-docs and subcontractors)

2012

Tetard, L.; Passian, A.; Jung, S.; Rogouskas, A.; and Davison, B., "Development of New Methods in Scanning Probe Microscopy for Lignocellulosic Biomass Characterization", *Industrial Biotechnology*, Vol. 8, No. 4, August 2012. [PDF Document](#)

Passian, A. and Thundat, T., "The abilities of instabilities," *Nature* 487, 440-441 (2012). [PDF Document](#)

Farahi, R.; Passian, A.; Tetard, L.; Thundat, T., "Critical issues in sensor science to aid food and water safety," *ACS Nano* 6(6), 4548-4556 (2012). [PDF Document](#)

Farahi, R.; Passian, A.; Tetard, L.; Thundat, T., "Pump-probe photothermal spectroscopy using quantum cascade lasers," *J. Physics D*, 45, 125101 (2012). [PDF Document](#)

Lereu, A.; **Passian, A.; Farahi, R.;** Abel-Tiberini, L.; **Tetard, L.;** Thundat, T., "Spectroscopy and imaging of arrays of nanorods toward nanopolarimetry", *Nanotechnology* 23, 045701 (2012). [PDF Document](#)

Lereu, A.; **Passian, A.;** Dumas, Ph., "Near field optical microscopy: a brief review," *International Journal Of Nanotechnology* 9(3), 488-501 (2012). [PDF Document](#)

Bonod, N.; Bouheller, A.; Koenderink, A.; and **Passian, A.;** "Optical Antennas" *International Journal of Optics*, Volume 2012 (2012). doi:10.1155/2012/365109. [PDF Document](#)

Tetard, L.; Passian, A.; Farahi, R.; Voy, B.; Thundat, T., "Applications of Subsurface Microscopy," in *Nanotoxicity: Methods and Protocols*, Edited by Joshua Reineke, Series: *Methods in Molecular Biology*, Vol. 926, 2012 (ISBN 978-1-62703-001-4) [PDF Document](#)

Karakaya, M.; Barstow, D.; **Villalobos, H. S.;** Thompson, J. and **Boehnen, C.;** "Gaze Estimation for ORNL Biometric Eye Model in Off-angle Iris Recognition", submitted to *IEEE Workshop on the Applications of Computer Vision (WACV 2013)*, (2012).

Karakaya, M.; Barstow, D.; **Villalobos, H. S.** and **Boehnen, C.;** "An Iris Segmentation Algorithm based on Edge Orientation for Off-angle Iris Recognition", submitted to *SPIE Electronic Imaging*, (2012).

Karakaya, M. and Qi, H., "Communication and Energy Efficiency in Visual Sensor Networks for People Localization", submitted to *3rd Future of Instrumentation International Workshop*, (2012).

Karakaya, M.; **Kerekes, R.;** Morrell-Falvey, J.; Foster, C. and Retterer, S., "Analysis of Tight Junction Formation and Integrity", accepted by *34th IEEE International Conference of the Engineering in Medicine and Biology, San Diego, CA*, (2012).

EVENTS
No Current Events

NEWS

March 2014
Dr. Aravind Mikkilineni joins the ISML Group

February 2014
Dr. Philip Bingham and Kurt Niel chair the Image Processing: Machine Vision Applications VII Conference
Dr. Trent Nichols and April McMillan accept full-time positions with the Boys Scouts of America to head the STEM program

November 2013
Dr. Trent Nichols and April McMillan receive the Community Outreach by a Team award

Dr. Derek Rose joins the ISML Group

November 2012
Dr. Chris Boehnen receives ORNL's Science & Technology – Early Career Award

September 2012
Artemis Magazine Article

April 2012
ISML Group Book Chapter in *Medical Imaging* edited by Okechukwu Felix Erundu released online

June 2011
ISML Iris Project Highlighted on Page 3 in the *Energy and Environmental Sciences Quarterly Newsletter*

September 2010

Fig. A-22 ORNL publications page⁴

The screenshot shows a web browser window displaying the ORNL website. The page title is "Imaging, Signals, and Machine Learning". The header includes "OAK RIDGE NATIONAL LABORATORY" and "EESR Division EES Directorate ORNL". The main content area is titled "Job Opportunities" and describes a "Postdoctoral Research Associate, Imaging and Computer Vision" position. The sidebar on the left contains navigation links like "Home", "About Us", "News & Events", and "Publications". The right sidebar contains "EVENTS" and "NEWS" sections with various announcements.

Fig. A-23 ORNL opportunities page⁴

A-4.5 Other Sources

Other web content discussed included principal investigator and lab members, research interests, publications, available positions, contact info, grants, methods, setup, tools, cooperative partners, awards, multimedia files, audio and videos, blogs, news, media coverage, interviews.

A website suggested for study is <http://www.the-scientist.com/?articles.view/articleNo/31108/title/Showcase-Your-Science/>.⁵

⁵ The Scientist webpage. Midland (Canada): LabX Media Group; 2016 [accessed 2016]. <http://www.the-scientist.com/?articles.view/articleNo/31108/title/Showcase-Your-Science>

A-5 Research@ARL Data

One publication intended to garner outside attention is Research@ARL. However, some questions have arisen as to how well it is serving its intended purpose. To give us a better sense of how well this is reaching audiences, we compiled data on the number of downloads of the various issues that have been published over the past several years.

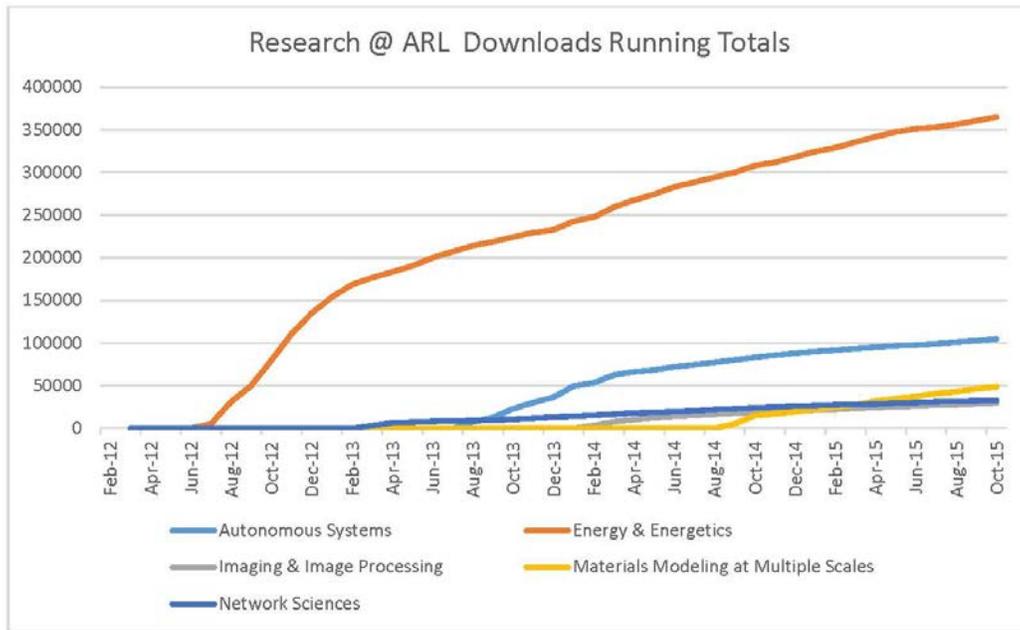


Fig. A-24 Data on total number of downloads of various issues of Research@ARL

A-6 Meeting Minutes

This section documents some of the discussions the group had in the form of meeting minutes. Note: The minutes appear in their original form, without editorial change.

ARL Technical Communication Working Group
10/26/2015 Meeting Minutes

*S:\GSmith\CHISCI\Tech Comm WG
Working Group Files will be stored here.*

Attendees

516

Gabe Smith
Garrett Warnell
Amy Finch

telecon

Chad Kessens
Eric Wetzel
Jean Vettel
Karin Rafaels
John Clayton

First meeting of the ARL Technical communication working group was held on 10/26.

Joe Mait attended briefly to discuss his perspective and motivation.

Gabe presented high level overview and goals of working group

A potential format of outcomes was discussed with examples.

The meeting fell in to an excellent discussion with many good points raised and are outlined below in the Discussion Points and Notes/Comments.

Jean provided the following guidance from RDECOM.
Placed for reference in *S:\GSmith\CHISCI\Tech Comm WG*
Telling the Army S&T Story PPT by Joe Ferrare Public Affairs Officer U.S. Army
Research, Development and Engineering Command
Next meeting will be determined from a doodle poll on week of 11/9.

Action items

Provide notes for minutes.

Member of the working group were asked to brainstorm the

- (1) Who is our audience?
- (2) What is our message?
- (3) How should we convey it?
- (4) How Often?
- (5) What outcomes do we want from these communications?

Jean agreed to start a Doodle Poll for week of 11/9.

Discussions points

To answer the question “To what extent does ARL Inside meet our technical communications goals?” We need to know what are the statistics of ARL Inside. Notably how many downloads? & Who downloads it?

Worry that TRADOC gets ARL Inside and doesn't really read it. How many others are distributed and set on shelf or coffee table.

YouTube is a natural way to convey message. General consensus is we are not using this properly.

ARL posted 4 videos in the last year. Not a ton of hits for many of them. Honey I'm Good had the most with 8K. Should we generate more videos to hit critical mass? For example do people watch more than one once in YouTube?

Eric commented that we need to focus on desired outcomes to guide strategy

- Recruiting better PhD students
- Attracting more customer funding
- Enhancing tech transfer
- Attracting academic Collaboration
- Demonstrate Value to customers

Jean added

- ARL Scientists to get invited talks
- Research Gate ARL related Accounts
- Aggregate ARL in Google Scholar, Linked In
- Invited Talks

Jean mentioned DOD Lab Day that RDECOM gave a lanyard with the talking points on cards

It was mentioned we should have corporate background slides with a common message and web link for more info

It was suggested that we find good websites for other excellent research labs to emulate

Our website is too text based

Karin concurred and said SLAD has been the same for 4 years

Documents on strategy and facilities are just PDF and should be integrated into the website

We need to do a better job of targeting audiences

Facetime is important to SLAD as they can't convey their.

Suggested on the website to make it more university oriented with a public page for each researcher.

Notes and comments from other members

Chad's comments

- Better data tracking for Research@ARL by asking users to input a small amount of information prior to downloading.

- Significantly boost upload rate to ARL's YouTube channel. Incentivize workforce to contribute by considering video uploads to the channel as part of communication metrics.

John's comments

1) Agree that ARL should enable publicly viewable web pages of individual scientists/engineers plus perhaps web pages of research teams/groups. It would be better if some personalization of such pages were allowed. Too much Army policy of "everyone is the same" reflects poorly for recruitment efforts. Young people, such as potential hires, want the opportunity to stand out and excel rather than just be a person in a seat serving as a part of a big machine. In research, most S&E's tend to follow work of individuals and small groups rather than research of an entire institution or laboratory. For example, I will look at a particular faculty member's site but don't really care about his University's main home page.

2) ARL website has terrible search capabilities. This is also true of ARL Inside. Really need to improve this.

3) I agree with Eric's suggestion to compare with other research laboratories. We might look to DOE labs such as LLNL, LANL, Sandia as good models for promoting scientific excellence. In my research area, we lose many good job candidates to these labs.

Jean's Comments

Outcome: increased recognition among researchers

-> a conglomerate of ResearchGate for ARL that has links to all ARL researchers

-> an ARL page that has links for google scholar pages

-> linkedIn ARL presence

-> youtube channel could have an ARL TED talks (many universities have one (<https://www.ted.com/tedx/events/719>))

NOTE: these will all address the issue of having a lab website that is up to date without a new team...

-> metrics: hits on these webpages; downloads of articles from ResearchGate; views on youtube; invites to give talks at universities for their colloquium; invites to give talks at conferences

Outcome: clearer strategic message for RDEC and GOs, etc

-> provide something akin to the RDECOM lanyards at DoD Lab Day at the Pentagon; attached is the slidedeck with the messages

-> ARCIC @ TRADOC puts out a daily email that has a front page summary of interesting news and then the following pages are the articles; this is how many folks have learned about my research because that highlight document included an interview with me about our work where the story was framed for public consumption but with the army relevance embedded.... so maybe there is some sort of roundup of ARL interviews that could be collated and posted somewhere? I don't have a strong suggestion yet. Just a base concept.

UNCLASSIFIED



**ARL Technical Communication
Work Group**

Meeting Feedback
26 October 2015

Eric D. Wetzel
Materials and Manufacturing Science Division
eric.d.wetzel2.civ@mail.mil 410-306-0851
Army Research Laboratory
Weapons and Materials Research Directorate
Aberdeen Proving Ground, MD 21005



UNCLASSIFIED **The Nation's Premier Laboratory for Land Forces**

- Outcomes should directly enhance ARL's mission:
 - Increase ARL resources
 - Increase the quality of ARL research
 - Advance the transfer of technology to the soldier
 - Increase ARL prestige *[I'm not sure this really is a separate outcome... I think prestige is a tool that can enhance some of the other outcomes]*

- A communication plan should be outcome-based, not task based
 - A strong outcome-based plan should have measurable metrics for success
 - Weak examples:
 - "ARL should publish more journal papers"
 - "ARL should get more hits on its youtube channel"
 - Strong example:
 - "ARL needs to establish a more effective means of targeting small and large industry partners to make them aware of ARL technologies available for license, and resources available to facilitate transition. Our goal is to establish a communication plan to increase the number of licensed ARL technologies per year by 50% in three years."

- Improve ARL staff morale and retention

- Attract higher quality postdocs

- Increase customer funding

- Attract higher quality external research collaborators

- Enhance tech transfer to industry

- Demonstrate ARL's value to high level decisionmakers (Congress, DoD, ASAALT, taxpayers)

Possible TCWG approach: Socialize these outcomes, get group to edit / remove / add, then assign each working group member one outcome to lead.

- **Need to select / tailor the right mix of mechanisms to achieve the outcome**

- **Mechanisms:**
 - Open Campus Open House
 - Site visits (to external)
 - Hosting visitors / tours
 - Webpage(s)
 - Conference publications / talks
 - Journal publications
 - ARL magazines / e-news
 - Media / press articles
 - Youtube
 - Google scholar / Linked-in

- **Do ARL individual performance plans have rated metrics for web hits, youtube videos, press articles, etc.?**

- **How does our strategy compare to high-performing research institutions:**
 - DoD: NRL, AFRL, RDECs
 - Industry: IBM, HRL
 - FFRDCs and similar: JPL, APL, Sandia, Draper Labs
 - Academia: MIT, JHU, UC Berkley, etc.

- **Benchmarking webpages and web-accessible research documents is most do-able**

Telling the Army S&T story

Communicating with a lay audience

Joe Ferrare
Public Affairs Officer
U.S. Army Research, Development and Engineering Command



APPROVED FOR PUBLIC RELEASE

What I Want to Leave You With

- The object of the exercise is to communicate
 - Express, not impress
- It's our responsibility to communicate, not the audience's to understand
 - We have the knowledge, we have to ensure delivery
- Assume no knowledge on the part of the other person
- People understand stories better than data
 - Stories have a beginning, a middle and an end
- Write your message, hone your message, practice your message



Public Affairs standard: 8th-10th grade reading level

DoD Messages

- **DoD Labs are advancing the capabilities of our Nation's Force of the Future.**
DoD labs are a critical component of the DoD Research and Engineering Enterprise, providing science, technology and engineering that gives our service men and women a warfighting edge while keeping them and our homeland safe. (DoD/BBP 3.0 message)
- **DoD scientists and engineers are engaged in some of the most exciting STEM work in the Nation.**
DoD laboratories are a place where the best and brightest scientists and engineers can make a positive global impact now and in the future. (STEM/Local message)
- **Public understanding of the complexity and diversity of the DoD Lab enterprise will help ensure that we maintain world class technical capability.**

The products of these 38,000 scientists and engineers across 22 states do more than many realize, including mitigating global disasters and supporting peace-keeping missions. (Internal and external media)



3

Army Messages

- **Science and Technology performed in our Army Labs and Centers are key parts of the Army's modernization strategy.**
The Army's Science and Technology strategic approach to modernization includes an awareness of existing and potential gaps; an understanding of emerging threats; knowledge of state-of-the-art commercial, academic, international and Government research; as well as a clear understanding of competing needs for limited resources. Innovation is a key part of this strategy and will provide the right capability to the Soldier at the right time.
- **Army Scientists and Engineers make us successful – Our workforce understands the problems faced by our Soldiers and the environments within which equipment must work.**
Army Scientists and Engineers consistently seek new avenues to increase the Soldier's capability and ensure our technological superiority today, tomorrow, and decades from now. These Scientists and Engineers conduct strategic outreach to academia, industry, and foreign partners focusing on new ways to approach our problems and new ways of doing business.
- **The Army S&T mission is not complete until we develop the right technologies that provide superior, affordable and overmatch capability for our Soldiers.**
Army Scientists & Engineers are committed to finding solutions to Army-unique challenges using the knowledge, skills and expertise resident in Army laboratories and centers and collaborating across-Services, National Labs, academia, industry and partner nations. Army is sharpening its research efforts to focus upon those unique core capabilities needed while identifying promising or disruptive technologies able to change the existing paradigms of understanding.



4

DASA-RT Themes and Key Messages

Army Science and Technology...

...Innovation for the Army of the Future

- The Army S&T community is the cornerstone of the Army's future
- Innovation is an important part of the strategy to provide the right capability to the joint Warfighter and the Nation, at the right time
- S&T enterprise primary goal is to provide capabilities enabled by knowledge and materiel solutions that empower, unburden, and protect our Soldiers in an environment of uncertainty and complexity
- The Army is committed to providing Soldiers with the best equipment available; their sacrifice deserves no less
- Investing wisely in people with innovative ideas to enable the Army of the future



5

RDECOM Messages

- The Army science and technology enterprise is the preeminent leader in research, development and engineering, delivering critical capabilities to the Army, the joint warfighter, and our Nation
- Army laboratories develop innovative technologies that ensure decisive overmatch for today through Force 2040 and Beyond
- Army labs leverage thousands of partnerships with industry, academia and international allies to deliver world-class capabilities to the Soldier, the Joint Warfighter and the Nation
- The Army is working to grow the next generation of scientists and engineers to meet National STEM priorities



6

Supporting Messages

- Army research aligns S&T efforts with the higher echelon S&T strategies, the TRADOC's Army Operating Concept, Technology Imperatives, and Army Warfighting Challenges
- The Army S&T community is delivering the capabilities critical to realizing the Army Chief of Staff's vision for Force 2025 and Beyond
- The Army S&T community ensures the decisive edge through collaboration with industry, academia, and international allies
- More than 12,000 Army scientists and engineers work across the S&T enterprise to deliver decisive capabilities for unified land operations and foundational capabilities for the Joint Warfighter
- Many Army S&T subject matter experts are recognized as worldwide experts in their fields



7

Lab Day communications

- Audience & venue require 2 go-to communications tools:
 - Elevator pitch
 - Command message
- Elevator pitch: Telling your story in 30-90 seconds
- Command message: one-sentence summary of the elevator pitch, focusing on the so what
- Have your background ready, but don't count on getting to say it

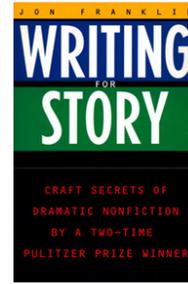


Needs of the audience determine the means of communication

8

Elevator pitch building 101: Tell your story

- Tell the story of your technology effort:
 - What was the Soldier vulnerability or opportunity?
 - Explain 1- 3 things about how development proceeded
 - Things you did – active voice
 - Check the messaging guidance to reinforce themes
 - How does the technology resolve or exploit the vulnerability or opportunity for the Soldier?



What is the so what?

9

Building an elevator pitch 101

1. Vulnerability/Opportunity - What started the effort
2. Action 1 - Thing(s) you did
3. Action 2 - Thing(s) you did
4. Action 3 - Thing(s) you did
5. Resolution/Exploitation - How did you resolve the vulnerability or exploit the opportunity?



What does it mean to the Soldier, Joint Warfighter & the nation?

10

Writing For Story: 30% increase in battery energy density

1. Vulnerability/Opportunity - Batteries burden Soldiers
2. Action 1 - Researchers study components
3. Action 2 - Researchers study interactions
4. Action 3 - Researchers develop additive
5. Resolution/Exploitation - Team reduces Soldier battery burden



Focus on capabilities

11

Telling the story of your technology

- Everything revolves around the Soldier/Joint Warfighter & the nation
- State everything as a capability
 - What are Soldiers capable of that they weren't before?
- Reference themes & messages
- Have back-up material for audiences that want it



Craft each sentence to communicate your story

12

Write your story & rehearse it

- Write a single sentence for each of the five points
- Hone that into your elevator speech
- Edit that down to a single-sentence command message
 - Be fully prepared to use it, and only it
- Practice your delivery
 - Say it enough that you develop muscle memory
- Test your readability in Word or online (i.e., read-able.com)
- Test it out on Beta listeners

Counts	
Words	494
Characters	2545
Paragraphs	50
Sentences	28
Averages	
Sentences per Paragraph	1.6
Words per Sentence	13.3
Characters per Word	4.8
Readability	
Passive Sentences	3%
Flesch Reading Ease	63.5
Flesch-Kincaid Grade Level	7.5



Public Affairs standard: 8th-10th grade reading level

13

What I Want to Leave You With

- The object of the exercise is to communicate
 - Express, not impress
- It's our responsibility to communicate, not the audience's to understand
 - We have the knowledge, we have to ensure delivery
- Assume no knowledge on the part of the other person
- People understand stories better than data
 - Stories have a beginning, a middle and an end
- Write your message, hone your message, practice your message



Public Affairs standard: 8th-10th grade reading level

14



DRAFT//PRE-DECISIONAL//FOUO

List of Symbols, Abbreviations, and Acronyms

AFRL	US Air Force Research Laboratory
AMC	Army Materiel Command
ARL	US Army Research Laboratory
ARO	Army Research Office
ASA(ALT)	Assistant Secretary of the Army (Acquisition, Logistics and Technology)
CAC	common access card
CISD	Computational and Information Sciences Directorate
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
HRED	Human Research and Engineering Directorate
JHU APL	Johns Hopkins University Applied Physics Lab
JPL	Jet Propulsion Lab
LL	Lincoln Lab
LLNL	Lawrence Livermore National Lab
MIT	Massachusetts Institute of Technology
NASA	National Aeronautics and Space Administration
NIPR	Non-Secure Internet Protocol Router
NPR	National Public Radio
NRL	US Naval Research Laboratory
OCOH	Open Campus/Open House
ONR	Office of Naval Research
OPSEC	Operations Security Office
ORNL	Oak Ridge National Lab
PAO	Public Affairs Office
PI	principal investigator

RDECOM	US Army Research, Development and Engineering Command
RDECs	Research and Development Centers
S&T	science and technology
SBIR	Small Business Innovation Research
SEDD	Sensors and Electron Devices Directorate
SIPR	Secure Internet Protocol Router
SLAD	Survivability/Lethality Analysis Directorate
SNL	Sandia National Labs
STEM	science, technology, engineering, and mathematics
STTR	SBIR Technology Transfer Research
TAD	technical assistant to the director
TCWG	Technical Communications Working Group
TRADOC	Training and Doctrine Command
TRs	technical reports
UF	University of Florida
UMD	University of Maryland
VTD	Vehicle Technology Directorate
WAR	weekly activity report
WMRD	Weapons and Materials Research Directorate

1 DEFENSE TECH INFO CTR
(PDF) DTIC OCA

2 US ARMY RSRCH LAB
(PDF) IMAL HRA MAIL & RECORDS MGMT
RDRL CIO L TECHL LIB

1 GOVT PRNTG OFC
(PDF) A MALHOTRA

7 US ARMY RSRCH LAB
(PDF) RDRL SER L
GABRIEL L SMITH
RDRL HRS C
JEAN M VETTEL
RDRL SED C
JENNIFER MULLINS
RDRL CII A
GARRETT WARNELL
RDRL SLB W
KARIN RAFAELS
RDRL SED E
BRENDAN HANRAHAN
RDRL VTA
CHAD KESSENS

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