

## **The Competitive Intelligence and National Security Threat from Website Job Listings**

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*This paper summarizes a study to assess whether U.S. defense firms publish too much sensitive information about their contracts in their Website job postings, therefore compromising U.S. national security and corporate business operations interests. The threat is that official public information from a company might be used against it. The study examined the Websites of three defense firms that will be referred to as Alpha, Bravo, and Charlie respectively. The listings were evaluated in terms of a set of sensitivity criteria aimed to quantify whether the companies are revealing sensitive information in their job postings. The results showed that 81% of the listings satisfied at least one criteria and more than half satisfied at least three. Consequently, the author recommends that firms err on the side of caution when posting jobs on their Websites. In particular, the author advises that human resources personnel and division managers collaborate in reviewing job ads for potential threats before posting them on the Web.*

**KEYWORDS:** Risk Assessment, Competitive Intelligence, National Security, Web Security, Defense, Information Security

## **Sensitivity Criteria**

This study summarizes a thesis project that examined the employment Websites of three defense firms. These defense firms will be referred to as Alpha, Bravo, and Charlie. One-hundred job vacancies were analyzed for each firm. For Alpha and Bravo, the 100 most recently posted openings were selected. For Charlie, 100 job listings were selected based on a keyword search for the company's name. The listings were evaluated in terms of 14 sensitivity criteria. These criteria were used to quantify whether the companies reveal sensitive information in their job postings. The criteria are as follows:

### **1. Requires a security clearance or U.S. citizenship.**

This criterion applies to positions that require a security clearance or U.S. citizenship. Examples of clearances are Top Secret, Single Scope Background Investigation, and Polygraph required. In some cases, the listing may say only that the candidate will be working with classified material. The rationale for this criterion is that it identifies the job as one relating to a sensitive project.

### **2. Requires a technical degree.**

This criterion is for positions that require a technical degree or indicates a strong preference for candidates with such degrees. The degree could be in engineering, physics, computer science, biology, chemistry, mathematics, or any other technical area and at any level. Certificates in technical areas also satisfy this criterion. For example, a Microsoft Certified Systems Engineer certification would satisfy this requirement. The rationale for this criterion is that it may offer clues about the types of projects performed by the company.

### **3. Provides specific technical terminology that might reveal sensitive information even if not put in context.**

This criterion applies to listings with terminology that only a person very knowledgeable in the field would understand. In these cases, the listings might reveal information about a project or client even if very little contextual information is provided. Since knowledge of the terminology is based on the individual's background, what one reader may consider technical terminology, another may not.

Technical terminology may be sensitive because understanding this terminology may offer clues about the type of project being completed. For example, what may appear to be technical software terminology to the average person may actually be the acronym for a top-secret project. Since the knowledgeable person might also have additional knowledge about that project, seeing that technical acronym in the listing could provide other clues about the project goals.

### **4. Names or suggests client, whether or not it is an intelligence or security agency.**

This criterion designates listings that name the client or strongly suggest who the client is by requiring applicants to have knowledge of that organization. For example, if a listing requires candidates to have knowledge of NASA standards, it will satisfy this criterion even if the listing does not state that the candidate will be working at NASA. The client may be any private, government, military or nonprofit agency of any size.

The name of the client can reveal sensitive information in several ways. First, the client may not want the general public to know the nature of its business relationships. Second, printing the

client name along with other information in a listing could reveal what types of products that client is developing. Finally, printing the client name may, in some cases, reveal information about the contracting company.

#### **5. Names or suggest national security, defense or intelligence agency.**

This criterion identifies listings that directly reveal or suggest a U.S. national security agency or defense agency. A listing that requires experience working with the CIA will satisfy this criterion even if the specifications do not directly state that the candidate will be working for the agency. If the listing names a comparable intelligence, defense or national security agency for a foreign government, this criterion will not be satisfied. A listing may satisfy this criterion if it named the military base where the work will be completed.

The reason for this criterion is that a person might find the naming of a national security or defense agency in a job listing to be a valuable end in itself. For example, a listing might reveal that the agency is conducting organization-wide testing on a service or a implementing a network upgrade. This type of information might signal a change in agency goals. The issues mentioned under the justification for Criterion 4 are also relevant here. That is, specifying the name of a defense, national security or intelligence agency in a listing may reveal sensitive information about the business and products of both the government client and contracting company.

#### **6. Names job skills that put in the context of other information in the listing make it sensitive.**

This criterion is for listings in which skills reveal information because the job specifications tell enough about a project or client to put them in context of mission goals or other important areas. These skills in themselves may not reveal specific information about any client or project. However, other specifications in the listing such as the client name, the city where the work will be completed or applications used can reveal sensitive information by putting these skills in context.

This criterion is included because some special job skills may reveal information if put together with other information. For example, a listing might require applicants to have knowledge of radio frequency modulation, a common skill in the engineering field but also name the contract or client. Thus, in this case, putting small pieces of information together may reveal a clearer picture about the type of project being completed as well as its specifications.

#### **7. Names corporate team or division completing project**

This criterion is designed to identify listings that named the corporate division or sector that is responsible for completing the project regardless of the client or type of work completed. Examples of named divisions might be the “Production Department” or the “Integrated Systems and Aerostructures Sector.”

Naming the team completing the project is included because revealing this information makes it easy for a person to exploit the information in the job listing by applying for the job or by calling and posing as a reporter.

#### **8. Reveals information by naming client site or city where work is to be completed.**

This criterion notes listings that may reveal information about a client or project by naming the city where the work will be completed or by designating the building name/number where the project will be completed. Examples of cities that may reveal information about a client or

project include: Albuquerque, N.M., (Department of Energy), Baltimore, Md. (the Navy) and Langley, Va. (the Central Intelligence Agency). A listing would also satisfy this criterion if it names a military base where the work will be completed.

Naming the client site or city where the project will be completed is included as a criterion because a person might draw some conclusions about the project with this information. He then might use social engineering to gain more information, especially if the listing reveals the exact building number where the project will be completed.

#### **9. Reveals information by naming job tasks.**

This criterion indicates listings that may reveal sensitive information by providing details on how the candidate will work, what goals are to be achieved or what types of work the candidate will complete to achieve these goals. An example of this criterion would include: “Design develop, analyze and operate imaging optical systems for tactical electronic information warfare applications.” Generally speaking, items that satisfy this criterion do not provide information that helps the applicant determine whether or not he is qualified for the position. Any listing that names the actual product to be delivered in this listing will satisfy this criterion. For example, if the listing says that the candidate will complete work on an F-14, it will satisfy this criterion.

Naming job tasks will satisfy this criterion because a person might exploit information simply by reading the listing. In this case, the information in the listing provides enough details about the project to be valuable in itself.

#### **10. Reveals information by naming contract or project to be completed**

This criterion denotes listings that name the contract that the firm is completing. Generally, contract names are either designated by a special number that is provided by the client, a product name or a word that the contracting company creates to designate the project.

For example a listing might refer to “Bravo Corp’s F-14 contract.” A listing that says the candidate will be completing work on F-14 planes would not satisfy this criterion because this is a generic reference to a product not to a specific contract. This is an important distinction, since a company may have one contract for F-14 planes or numerous contracts for F-14 plane projects. In the final case, the firm may designate a word such as “ARROWHEAD” to refer to a contract. In such cases, further research, perhaps on the company’s Website might reveal what the ARROWHEAD project is, what services are delivered, when and to what clients.

A person might use knowledge of a project name to acquire additional information through social engineering. The person might call posing as a high-ranking supervisor demanding specific information about project details.

#### **11. Names special directives, laws or procedures that the candidate must know.**

This criterion indicates federal laws, military directives or procedures the candidate must know to qualify for the position. For this criterion, the type of procedure and the sector of the economy affected by the procedure are irrelevant. If a listing requires a candidate be familiar with Department of Defense (DOD) procedures but does not name any specific procedures, it will still satisfy this criterion. Requirements that a candidate be familiar with corporate procedures will also satisfy this criterion.

Naming directives, laws or procedures satisfy this criterion because a person might exploit these requirements to draw conclusions about who the client is and/or what type of project is being completed. This is especially true of federal regulations, since federal regulations are

published widely. Corporate procedures are less widely circulated but might be exploited by calling posing as a student conducting research.

### **12. Reveals size or scope of project by providing staffing size or other related information.**

This criterion refers to listings that reveal how many people will work on a contract, how many sites will be utilized, how big the output will be or the project timeline. If any of these areas are provided in the listing then this criteria will be indicated in the chart and accompanying analytical description.

The rationale for this criterion is that a person might exploit project size or scope information to draw conclusions from the contents of the listing itself. A listing that quantifies the number of personnel working on the project may also reveal information about the importance of that project. This is especially true if other specifications in the listing provide additional information about the type of project completed. A person might also seek other listings on the Website that appear to be related to the opening then draw additional conclusions about the project.

### **13. Reveals sensitive procurement or acquisition information.**

This criterion designates listings that provide information on shipments, deliveries or the installation of systems. These specifications can provide valuable information about changes in how the company does business if they are put in context. An example of a listing that would satisfy this criterion is one that names a product and describes the candidate's role in procuring it for a client, which may be also named. Another example might be revealing that Alpha is procuring a new accounting or human resources system for its internal operations. Information on shipments and deliveries can be valuable because it can reveal when projects are being completed, where and who the client may be.

The rationale for this criterion is that procurement information might be exploited to legally acquire competitive intelligence from a direct competitor. Procurement information may be valuable in itself.

### **14. Reveals sensitive business operations information**

This criterion indicates listings that reveal sensitive information about the contracting company whether or not procurement is involved. An example of sensitive business operations information may include the size of the contract (in personnel or dollar value), revealing corporate capability specializations and where the work will be completed. Usually a listing that satisfies Criterion 14 above would also reveal sensitive business operations information. This is because sensitive procurement information can usually also be considered sensitive business operations information. However, a listing that reveals sensitive business operations information does not necessarily reveal sensitive procurement information.

Sensitive business operations information is included as a criterion because a person might take advantage of it in a manner similar to that mentioned in Criterion 14.

### **Examples**

The following three examples illustrate how the criteria were applied to job listings for Alpha, Bravo, and Charlie. The examples show which criteria were satisfied and suggest scenarios where the information in the listing might be exploited as well as justifications for these scenarios.

**Listing Number:** A31

**Criteria Satisfied:** 2, 4, 6, 7, 8, 9, 10, 11, 13, 14

**Position:** Sr. Sys Integration Analyst [sic]

**Description:** This listing for a systems integration analyst tells who the client is, where the client is located, why there is a need for this position, what skills the candidate will use to complete the project, how he will complete the project and what the end product will be. The listing also provides sensitive procurement and business operations information about how the product will be used for management and customer solutions. Specifically, it tells that Alpha is upgrading its human resources database and requires configuration and development support.

**Justification:** Advising the general public that a core division is changing its business process system makes the company prime target for espionage by social engineering, site visits, job application, student inquiries and other means.

**Scenario:** A senior officer of an American competitor of Alpha learns that Alpha is modifying its human resources recruiting system by reviewing a job listing from the company's Website. He shows the job skills and specifications to his firm's technology director for human resources. In his discussion, the officer learns that his firm's human resources recruiting system is in danger of becoming obsolete if it is not upgraded soon. The officer advises the director of human resources that this is a top company priority.

**Listing Number:** B14

**Criteria Satisfied:** 2, 6, 7, 8, 9

**Position:** Engineer/Scientist, Systems Engineering

**Description:** This position for a systems engineer may reveal information by listing the type of skills required for the job as well as a description of the tasks to be completed. The candidate will prepare and update procedures and drawing documentation for management display systems including networking, timing clocks, telemetry data, display software and launch scripts. A person knowledgeable about the specific job tasks might be able to draw some conclusions about the scope of the project as well as who the client may be. In addition, the listing names the business component completing the work as well as the exact building where the work will be completed.

**Justification:** Identifying specifications like building number and location can provide sensitive information in conjunction with other similar job listings at the same site.

**Scenario:** Lou, a political attaché at foreign embassy, finds a listing for an engineer position on Bravo's Website. He finds the contents of the listing useful so he does a random search on Bravo's Website for listings at the same site. Out of the next 99 listings, fourteen are at the same location. Many of these positions are openings for engineers in working the same area and in the same building. He draws some conclusions then puts together a report that is sent to a team leader in his home country.

**Listing Number:** C24

**Criteria Satisfied:** 1, 7, 8

**Position:** Controllers Administrator

**Description:** This position for a controls administrator, which requires a security clearance, names the corporate division responsible for the project, names the city where the client site is

located. It also tells what program the candidate reports to. However, it does not provide specific information about any project.

**Justification:** Providing information about the type of project completed and its location can make it vulnerable to site visit espionage by field experts, especially if the field in question is very technical.

**Scenario:** Dan, a professor of physics at a large U.S. university and a foreign agent, requests a site visit of a special space program after reading a job listing for the position. After securing permission for a site visit, he requests an information packet to prepare for the visit. He reviews the packet then prepares questions for his site visit. He is able to learn valuable information during his visit. He turns this information over to his case officer and is paid for his services.

## Findings

Table 3.1 shows the number of job ads satisfying each of the 14 criteria for each of the three companies. Since each data set has 100 elements, these values correspond to percentages. The table also gives averages for the three companies taken together. These correspond to percentages for the aggregate of all three data sets, i.e., all 300 job ads.

**Table 3.1: Percent of Job Ads Satisfying Each Criterion**

Criteria Number	Alpha	Bravo	Charlie	Average
1	20	20	67	35.6
2	54	36	59	49.6
3	18	14	9	13.6
4	22	14	20	18.6
5	3	9	19	10.3
6	26	16	21	21.0
7	10	37	100	49.0
8	3	29	23	18.3
9	21	23	15	19.6
10	9	9	3	7.0
11	9	11	5	8.3
12	3	2	0	1.6
13	2	3	0	1.6
14	4	9	0	4.3

Table 3.1 shows, for example, that 20% of the listings for Alpha and Bravo satisfied Criterion 1, while 67% of the Charlie ads did. It also shows that Criterion 14 was satisfied by 4% of Alpha listings, 9% of Bravo listings and 0% of Charlie listings. Chart 3.1 graphically presents the data from columns 2, 3 and 4 of Table 3.1. Table 3.2 shows a rank ordering of the criteria for the aggregate data.

Table 3.3 gives cumulative statistics for the number of job ads satisfying X or more criteria. For example, 74% of Alpha job listings satisfy 1 or more criteria, 46% satisfy 2 or more criteria and 31% satisfy 3 or more criteria. No Alpha listing satisfies 11 or more criteria. The final column in Table 3.3 gives the averages of the three companies, which is also the cumulative percentages for the aggregate of all three companies. Chart 3.2 graphically presents the data from columns 2, 3, and 4 in Table 3.3.

**Table 3.2: Rank Ordering of Criteria by Percentage of Job Ads Satisfying Criteria in Aggregate**

Criteria Number	Aggregate percentage (average)
2	49.6
7	49.0
1	35.6
6	21.0
9	19.6
4	18.6
8	18.3
3	13.6
5	10.3
11	8.3
10	7.0
14	4.3
12	1.6
13	1.6

**Table 3.3:  
Statistics  
of Listings  
More Criteria**

**Cumulative  
Showing Percent  
Satisfying X or**

Minimum Number of Criteria Satisfied	Alpha	Bravo	Charlie	Average
14	0	0	0	0.0
13	0	0	0	0.0
12	0	0	0	0.0
11	0	0	0	0.0
10	1	0	0	0.3
9	2	2	0	1.3
8	3	2	2	2.3
7	5	6	3	4.6
6	7	8	10	8.3
5	15	16	27	19.3
4	21	27	41	29.6
3	31	49	72	50.6
2	46	53	86	61.6
1	74	70	100	81.3
0	100	100	100	100.0

### Interpretive Analysis

Although there are 14 criteria, no listing satisfied more than 10 criteria. Interestingly enough, every Charlie listing satisfied at least one criterion, namely Criterion 7. In contrast, 26% of Alpha job listings and 30% of Bravo job listings did not satisfy any criteria.

Table 3.1 shows that the three companies did not often reveal certain types of information in their job listings. For example, Criteria 10, 11, 12, 13 and 14 did not appear often in the job listings from the three companies. In all but one case the percentage of job listings satisfying Criteria 10, 11, 12, 13 or 14 fell below 10%. The exception was Criterion 11 for Bravo, where the percentage of listings satisfying the criterion was 11%. In 8 of the 15 boxes that represent the results for Criteria 10 to 14, 3% or fewer of job listings satisfied any of these 5 criteria. Some of these criteria that do not appear often in the job listings are potentially the most sensitive. For example Criteria 13 and 14 can potentially reveal significant information about



how a company does business with its clients and conducts its internal operations. That they are not satisfied as much as some of the other criteria may suggest that these firms are doing a better job of protecting their most sensitive data than some of their less sensitive data.

As noted above, Charlie revealed the corporate team or division completing the task (Criterion 7) in 100% of the firm's job listings. On the other hand, only 10% of Alpha job listings and 37% of Bravo job listings satisfy this criterion. However, the statistic for Charlie may provide a distorted picture since the listings sometimes only provided the sector rather than the name of a division. Specifically, the listings often signified that the task is completed for the "Electronic Sensors & Systems Sector" or the "Corporate" sector.

Nevertheless, a number of Charlie job listings revealed what industry or corporate subsidiary was completing the project. This information was most valuable in the context of other information in the listing that described the project or named the client. In other cases, revealing a corporate team or division in a Charlie job listing appeared not to reveal much information. Typically jobs in divisions such as the human resources department and the legal department did not reveal much information. In fact, by the nature of the job listing the reader might presume that that a position such as a legal counsel would work in the legal department of the company.

Bravo listings provided a significant amount of information about the team and even the location of the project to make it very valuable to a perpetrator. For example, they often give an entire dossier of specifications that are unrelated to job skills including: business component and location (including building number).

The location of the client site (Criterion 8) in itself may not to be a good indicator of whether sensitive information was revealed. This is partly because it can be difficult to determine exactly what locations reveal sensitive information if named. For example, a position in Annapolis may provide services to a Navy client but may just as easily serve another client that has no ties to the armed forces service. Perhaps a better indicator would be to assess how many jobs for a given firm are at the same location and appear to be related, perhaps because they are in the same building. For example, 13% of Charlie's positions were located in Huntsville, Alabama but only 1% of its listings were for jobs in Pt. Mugo, California. It might be useful for a perpetrator to consider the contents of these listings in Huntsville, Alabama, in this context.

More Charlie job listings named national security clients (Criterion 5) than either Alpha or Bravo job listings. However, the total number of clients (national security or otherwise, Criterion 4) named in Alpha listings (22%) is slightly higher than the number named in Charlie listings (20%). Of the Alpha listings that name the clients, only 3% were national security agencies.

While Charlie revealed more information than Alpha and Bravo in many categories, the two firms revealed more information using specific terminology (Criterion 3) than Charlie. Charlie has specific terminology in only 9% of its job listings. Alpha has special terminology in 18% of its listings and Bravo has special terminology in 14% of its listings. Alpha and Bravo also reveal more information by naming job tasks in company job listings than Charlie. The percentages were: Alpha (21%), Bravo (23%), and Charlie (15%).

While the possibilities are potentially endless, in some cases it might also be useful to combine two or more criteria for sensitivity. For example, a requirement for a technical degree (Criterion 2) in itself does not appear to be useful because the criterion may be too generic. However, combining a requirement for a technical degree with a requirement for a security clearance (Criterion 1) may be useful, since the combination reveals where the technical degreed professionals are needed the most. When these two criteria are combined, the results are: for

Alpha, (14%); for Bravo, (5%); and for Charlie, (47%). It's noteworthy that Charlie has a higher percentage of listings that satisfy these two criteria than Alpha or Bravo combined.

Criteria 2, 7, and 1 have the highest averages, namely 49.6% for Criterion 2, 49% for Criterion 7 and 35.6% for Criterion 1. However, the difference between the high and low for all three criteria is over 15%, throwing off the averages. For example, only 10% of Alpha's job listings satisfy Criterion 7 while 100% of Charlie's listings satisfy the same criterion. Criterion 1 also shows a wide range between the high and low. Both Alpha and Bravo job listings satisfied Criterion 1 in 20% of the job listings. On the other hand, Charlie job listings satisfied Criterion 1 in 67% of the job listings.

Criteria 6, 9, 4, 8 and 3 aggregate statistics range between 21% and 13.6%. However, the range between the high and low for Criterion 8 and Criterion 5 also falls above 15%, again throwing off the averages. For example, only 3% of Alpha job listings satisfied Criterion 5 while 19% of Charlie job listings satisfied that same criterion. The remainder of the criteria (Criteria 11, 10, 14, 12, 13) had total aggregate statistics at or below 10.3%. This should not be a surprise given that some of the data sets had no job listings that satisfied these criteria. For example, no Charlie job listings satisfied either Criterion 13 or Criterion 14.

Table 3.3 shows that few job listings satisfy 6 or more criteria in any of the data sets. Moreover, the differences were not great among the three companies in cases where 6 or more criteria were satisfied. For example, 10% of Charlie job listings satisfy a minimum of 6 criteria while 7% of Alpha job listings satisfied a minimum of 6 criteria, a difference of only 3%. However, when the minimum amount of criteria satisfied drops to 5 or more the number of job listings go up and the differences between the three data sets become more apparent. For example, 15% of Alpha job listings satisfy a minimum of 5 criteria but 27% of Charlie job listings satisfy the same number of criteria. The average percentage of job listings that satisfy a minimum of 5 criteria for the three data sets is 19.3%.

When a minimum of 4 criteria is satisfied, the average percentage of job listings is 29%. The difference between the high and low percentage in this row is 20%. The average percentage of job listings that satisfied a minimum of 3 criteria is 50.6%. At this level, the gap between the high and low number of criteria satisfied for the data sets is 41%. The average percentage of Charlie listings was boosted by the fact that 100% of its job listings satisfied Criterion 7.

## **Independent Validation**

The independent verification of the subset of data yielded a high level of agreement between initial coding and independent testing. For the Alpha subset, agreement between the initial coding results and independent coding results was 91.4% for Bravo, it was 93.6% and for Charlie 90.7%. The average for all three companies was 91.9%

## **Conclusions**

The results of this research provide insight on the challenges U.S. defense firms face in publicizing their job openings on the Web. They also suggest that it is not always easy to quantify to what extent these companies are revealing defense classified information or corporate secrets. This is partly because several criteria may be biased by the subjectivity of the reviewer.

For example, what one reviewer may consider technical terminology another may not. In addition, it should be noted that such terminology does not necessarily reveal sensitive

information. If the reviewer is not familiar with the meaning of a technical term in a job listing, he cannot determine whether it reveals sensitive information.

Despite the difficulties in quantifying some types of information, the research results provide insight on what defense firm's employment Websites may reveal about themselves and their national security clients.

For example, initial research shows that some defense firms may be revealing some types of sensitive information in their Website job listings but protecting other types in these same job listings. Specifically, the initial research suggests that these firms may be protecting Criteria 10, 11, 12, 13 and 14. These 5 criteria do not appear often in any of the job listings. Of particular interest, no firm revealed information about project size or scope in more than 3 job listings. This is important because project size or scope could potentially reveal a great deal about a contract in itself.

In addition, initial research suggests that some firms protect certain types of information (eg. Criteria 1, 2, 5, 6, 7, 8) better than other firms protect that same information. For example, Alpha job listings projected information on client sites (Criteria 8) much better than either Bravo or Charlie. Both Alpha and Bravo revealed information about technical degree requirements (Criteria 2) less often than did Charlie. However, providing information on degree requirements may be necessary to help jobseekers determine whether they are qualified for the positions advertised.

This research suggests that the combination of several criteria in a job listing may reveal sensitive information where individually they would not. Finally, initial research suggests that perpetrators may be able to draw conclusions by looking at several job listings together.

## **Recommendations**

This research shows that it is possible to apply defined criteria for sensitivity to a set of job listings. However, this does not necessarily mean that the companies selected for this research would consider the information in their job listings to be overly sensitive. Each company needs to make its own assessment about what information is sensitive, why that information is sensitive and who the most likely perpetrators are.

Nevertheless, the research suggests that certain information provided in job listings is potentially sensitive, while not being relevant or essential to applicants. Therefore, the author recommends that companies with national security community contracts not provide such information. At a minimum, the author recommends that job listings not include building numbers or the names of national security clients.

While naming the client in the job listing may help the jobseeker make a decision, each firm needs to weigh the benefits of providing such information against the risks. The author recommends that firms endeavoring to protect their sensitive information from perpetrators and competitors make an effort to coordinate recruiting activities with other operations they conduct. For example, division managers could take responsibility for reviewing their own listings. These could then be double-checked by personnel in human resources. However, because the latter may not be familiar with certain technical terminology that could reveal sensitive information, it is important that the divisions themselves review the listings. Human resources would focus on generic categories of information such as client names.

Because employees may not be aware of the security problems with job listings, the author recommends that companies provide department managers and human resources staff with the

training and tools they need to raise their awareness of information security as it relates to writing job listings. The author recommends that firms raise manager awareness of the issue by publishing guidelines on what should be put in ads and what should be left out of them.

Another approach that could be implemented in conjunction with manager review would involve using automated tools or search agents to scan job listings in word processing or database software that maintain corporate job listings before they are posted on the Web. An effective search engine could flag listings with potentially sensitive information. A tool could also search for information across multiple listings.

For example, a tool could be set to find job listings that are located at the same site. Such a tool could help managers determine whether a set of job listings provides more information about their business operations, contracts or clients than they want posted on their Website. However, automated search agents have mixed results. For example, keyword searches on Yahoo! and search engines often suffer from lexicographic ambiguity.

That is, search engines may not be able to distinguish between two words that are spelled alike but have different meanings. For example, Bravo job listing Number 25 has the requirement "knowledge of deliverables." An automated search agent might flag this structure as providing information about shipments and deliveries. Alpha job listing Number 22 names U.S. Marshal as the client. However, since "marshal" has multiple meanings, including that of an usher, a search agent might also pass over this unless it was specifically instructed to seek out the word.

In summary, because of the negative consequences of releasing information inappropriately, firms should be very careful about what they post in the Internet job listings. Since the loss of a company's information can result in its loss of competitive advantage, cost it billions of dollars or even put it out of business the author recommends that these firms err on the side of caution when posting jobs on their Websites. The author recommends that firms that have contracts with the defense and national security community be particularly careful about the content of their Website job postings.

