Meet the New Remote Sensing Professionals

New job titles provide employment structure and related skills in this expanding sector of the geospatial industry.

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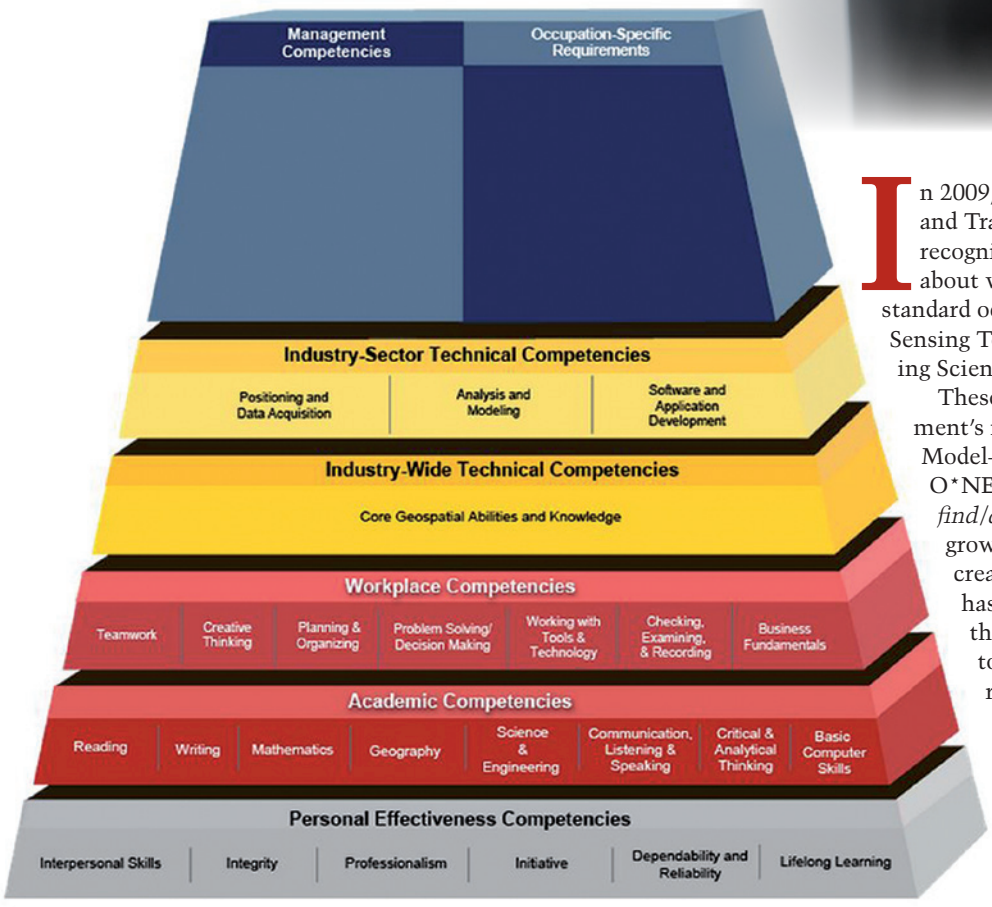
Figure 1. Geospatial Technology Competency Model



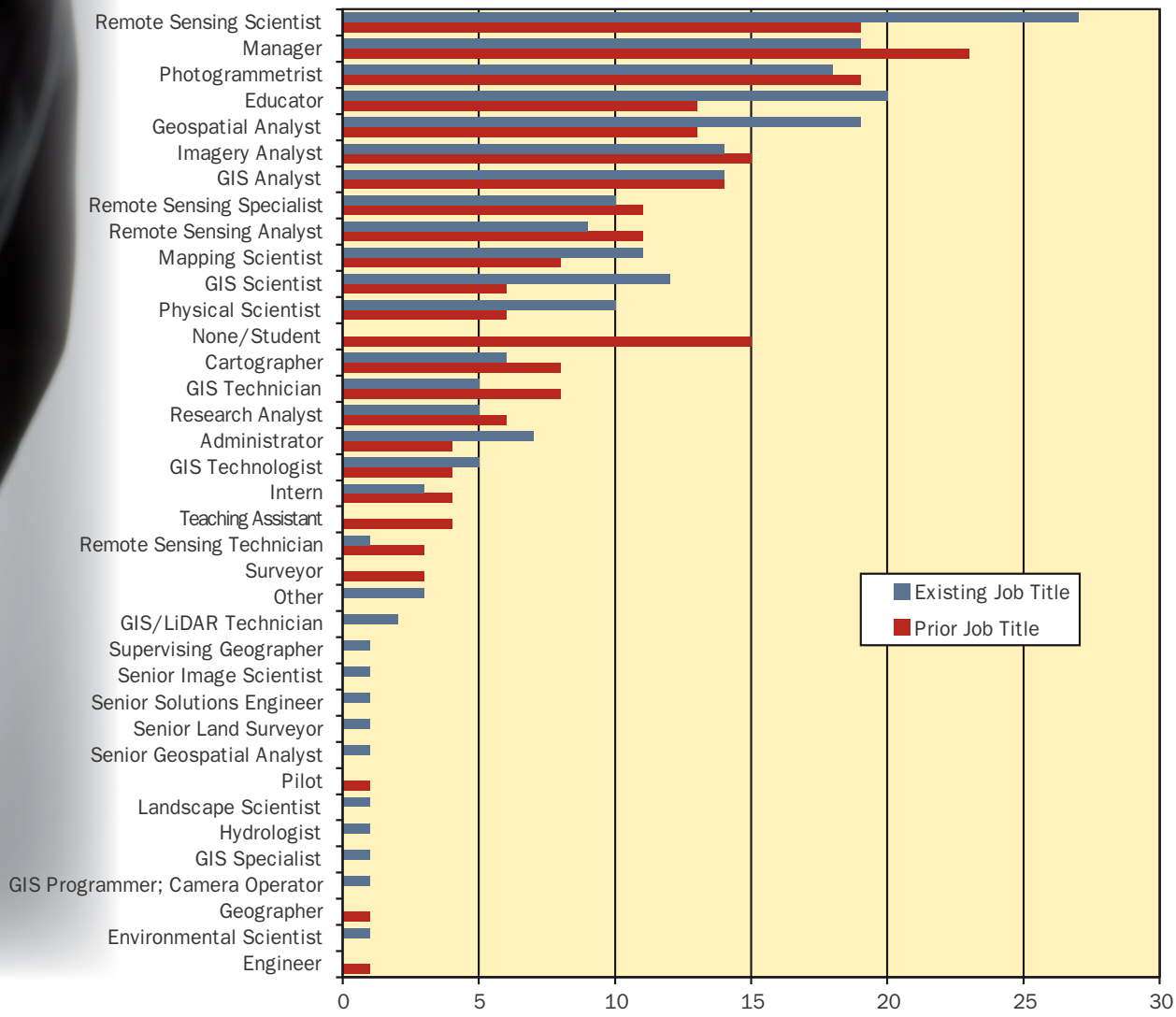
In 2009, the U.S. Department of Labor Employment and Training Administration (DOLETA) formally recognized the remote sensing field. This came about with the department's creation of two new standard occupational classification codes for "Remote Sensing Technicians" (19-4099.03) and "Remote Sensing Scientists and Technologists" (19-2099.01).

These positions, which are included in the department's new Geospatial Technology Competency Model—shown in Figure 1 and described on its O*NET website (*http://online.onetcenter.org/find/quick?s=remotesensing*)—are expected to grow at a rate of up to 13 percent by 2018. By creating and defining these job titles, DOLETA has set the stage for detailing what workers in these positions actually do. This is necessary to identify the knowledge, skills and abilities required, as such requirements typically form the basis for related educational and training programs.

Job Analysis

In 2010, the GeoTech Center (*www.geotechcenter.org*) at Del Mar College,

Figure 2. Existing and Prior Job Titles or Positions of Remote Sensing Professionals



Corpus Christi, Texas, reviewed and validated similar DOLETA workforce information for "GIS Technician," another new geospatial job title. The process used the Developing a Curriculum (DACUM) job analysis technique to precisely determine what geographic information system (GIS) technicians do at their jobs.

DACUM is unique in that it relies directly on panels of "expert workers" to describe and define their own jobs. Because one panel of workers may not adequately represent the diversity of a job at the national level, multiple DACUM job analyses were conducted at various U.S. locations. A unique meta-analytic technique was used to consolidate these job analyses into a single national assessment, which generated a detailed list of job tasks that were identified, validated and ranked by working GIS technicians and related practitioners. The report also identified the knowledge, skills and abilities these workers considered important for their jobs.

This assessment was used to expand and authenticate DOLETA's list of GIS technician job tasks. It also served as a basis for GeoTech's model course outlines, which were designed to help the nation's 164 community college GIS certificate programs prepare students for work as GIS technicians (see "Looking for Geospatial Education?" page 38).

The GeoTech Center has used a similar approach, along with a national industry survey, to help further define and validate the job of "remote sensing technician." Again the goal was to help clarify exactly what these workers actually do to help identify their common knowledge, skills and abilities.

Employment Survey

In 2010, the GeoTech Center began researching remote sensing technicians with a national employment survey conducted during the summer of 2011.

Most career opportunities in remote sensing are with large government or private-sector organizations.

A link to the survey was e-mailed to U.S. members of the American Society for Photogrammetry and Remote Sensing (ASPRS), a scientific association serving more than 7,000 geospatial professionals worldwide. Figure 2 shows that survey respondents had a variety of existing and prior job titles or positions, including photogrammetrists, geospatial scientists,

Figure 3. Remote Sensing Training

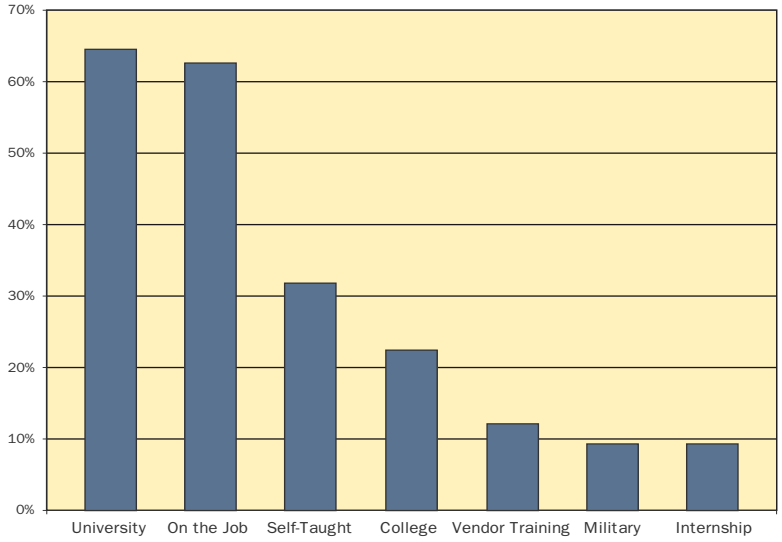


Figure 4. Remote Sensing Specialist Job Task Categories and Groups*

Category *Group (Tasks)*

MANAGE DATA (60)
- Convert/reformat data (10)
- Upload/download data (7)
- Create data storage structure (5)
- Maintain/organize data (5)
- Inventory available data (5)
- Backup & restore data (4)
- Generate scripts & queries (4)
- Select appropriate data (4)
- Order data (3)
- Create & edit metadata (3)
- Assign data access (3)
- Research data sources (3)
- Assess data quality (2)
- Create templates (1)
- Scan data (1)

IMAGE PROCESSING (47)
- Image classification (20)
- Image enhancement (5)
- Image management (Subset, clip, crop, mask) (4)
- Mosaic/coregister images (4)
- Radiometric claibration (4)
- Sample/resample image data (3)
- Reproject/transform data (3)
- Visual interpretation (2)
- Georeference data (2)

MANAGE PROJECTS (46)
- Clarify project scope & objectives (9)
- Evaluate project personnel (6)
- Monitor project status (6)
- Communicate with client(s) (5)
- Define project methodology & timeline (4)
- Allocate project resources (4)
- Write proposals (3)
- Prepare budget (3)
- Streamline workflow (3)
- Prepare project plan (2)
- Contribute to company's strategic plan (1)

ANALYZE DATA (45)
- Quality assurance & quality control (10)
- Quantative analysis (6)
- Feature extraction/image segmentation (6)
- Conduct resource and scenario analysis (6)
- Integrate data (5)
- Change detection (4)
- Model surfaces (4)
- Statistical analysis (3)
- Proximity analysis (1)

Category *Group (Tasks)*

DEVELOP PROFESSIONALLY (32)
- Attend training & workshops (4)
- Participate in conferences, seminars and workshops (4)
- Read professional literature (4)
- Prepare & conduct training (4)
- Participate in professional outreach (4)
- Acquire professional certification (3)
- Pursue advance degrees & certificates (3)
- Mentor others (1)
- Network professionally (2)
- Contribute to publications (1)
- Inventory personal skills (1)

SOFT SKILLS (25)
- Post/publish/print digital data (9)
- Prepare & give presentations (6)
- Compile deliverables (4)
- Write reports (3)
- Create charts (1)
- Create tables (1)
- Prepare exhibits (1)

COLLECT FIELD DATA (17)
- Plan field missions (9)
- Collect ground control points (8)

CREATE AND EDIT DATA (12)
- Create & edit vector data (4)
- Create maps (4)
- Create animations & fly-throughs (4)

PHOTOGRAMMETRY (8)
- Create photogrammetric data (3)
- Orthorectify data (3)
- Plan field mission: photgrammetric data (2)

MAINTAIN HARDWARE AND SOFTWARE (6)
- Maintain software & services (4)
- Maintain hardware (2)

LIDAR (3)
- Create LiDAR-based products (3)

Note

This is a summary of job tasks identified by three panels of Remote Sensing Specialists. Tasks have been grouped into categories and arranged by order of frequency. This is an indicator of the relative significance of these tasks to this job. For a complete list of the actual 301 tasks see:
www.geotechcenter.org/Resources/Publications/Remote-Sensing-DACUM-Meta-Job-Analysis

**Brackets indicate the actual number of job tasks.*

analysts, managers, specialists, technologists, technicians and many others.

Although the most common job title was "Remote Sensing Scientist," the variety of positions and job titles cited by respondents suggests there are many ways to advance in the industry. In addition, no clear starting point for entry-level workers is evident, although the DOLETA's creation of the "Remote Sensing Technician" position may be an attempt to address this issue.

The median age of survey respondents was between 41 and 50, with 14 percent over the age of 60. This suggests that many in the industry are nearing retirement, which should lead to job advancements and additional opportunities for new workers.

In addition, remote sensing workers are highly educated, with virtually every respondent having earned a bachelor's degree, almost 75 percent a master's degree and one-third with doctorates. The degrees were from a variety of subject areas, with geography as the most popular followed by geology, environmental science, GIS, photogrammetry, remote sensing and others.

Although a university education clearly is important for these workers, Figure 3 suggests that much of their actual remote sensing training originated from a combination

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Looking for Geospatial Education?

The GeoTech Center (*www.geotechcenter.org*) at Del Mar College, Corpus Christi, Texas, is a collaborative effort among colleges, universities and industry to expand the geospatial workforce. The center's partners work together to provide professional development, teaching and curriculum resources, career pathways and model core competencies for geographic information system (GIS) technicians and technologists. If you're looking for geospatial education, check out the center's GIS program finder at *http://216.69.2.35/flexviewer/index.html*. Additional information on the service's Map Interface is online at *www.youtube.com/watch?feature=player_profilepage&v=tOhnSNzVDUU*.

of on-the-job, self-taught, college and vendor offerings. In addition, despite the availability of multiple industry certifications through ASPRS and other organizations, almost 60 percent of respondents hadn't yet earned a certificate. This is evidence that training opportunities currently exist within the industry.

More than three-quarters of the survey respondents worked for large public- or private-sector organizations with more than 25 employees, and half of these organizations employed at least five full-time remote sensing workers. These respondents primarily worked in the government, education, mapping, charting, defense and intelligence sectors. This suggests that most career opportunities in remote sensing are with large government or private-sector organizations. The remote sensing professionals who responded to the survey were concentrated in

California, Virginia, Washington and Florida, which coincides with the location of several large industry employers, including the National Geospatial-Intelligence Agency and the U.S. Army Corps of Engineers in Virginia, as well as U.C. Berkeley and NASA Ames in California.

Meta-DACUM Job Analysis

Along with the employment survey, the GeoTech Center conducted the three remote sensing technician DACUM job analyses in San Jose (2009), Milwaukee (2011) and Denver (2011). During the course of each workshop, however, panel members identified themselves more as "specialists" than "technicians," reflecting the greater scope and complexity of their jobs. This was consistent with survey results, which suggested that the job title "remote sensing technician" currently isn't widely used in the industry.

Results from these analyses, which now documented "remote sensing specialists" instead of technicians, were combined into a single meta-analysis, which involved consolidating 301 job tasks into 74 task groups and 12 task categories. This was done with input and assistance from the Milwaukee and Denver DACUM panels. Figure 4 lists these groups and categories arranged in decreasing order of size to indicate their relative significance to this job.

Manage data was the largest task category, with a total of 60 job tasks organized into 15 groups. This was followed by three roughly equal-sized categories: image processing, manage projects and analyze data. Each represented about 46 job tasks organized into 10 groups. These four task categories accounted for the bulk of all job tasks performed by remote sensing specialists. Additional task categories were professional development, soft skills, field data collection, data creation and editing, photogrammetry, hardware and software maintenance, and light detection and ranging (LiDAR) technology.

Panel members also identified a subset of these task groups as "entry level." Although there was some disagreement on this, it was evident that entry-level technicians could perform a significant number of these job tasks.

Final Results

The DOLETA's creation and definition of the "Remote Sensing Scientists and Technologists" and "Remote Sensing Technician" job titles should help to better define a job ladder and provide a structure for employment in this expanding new sector of the geospatial industry. At this point, however, there's no clear entry point for new workers, making it difficult to define the knowledge, skills and abilities they require. One solution is to use entry-level job tasks performed by more senior remote sensing specialists as the basis for defining what remote sensing technicians must know. This would enable educators, students and prospective workers alike to target new jobs in this industry.