GIS / Geospatial Technician Workforce Competencies

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Table 1

GIS Technician Task Competencies - Tier 7 (Summary)

Ranked by Consensus among DACUM Panels and Complexity

#	Task Categories	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
1	Design & create maps (G1)	8	34	medium	846	medium	785
2	Develop/document procedures (F4)	8	13	medium	296	medium	265
3	Conduct geoprocessing (D1)	7	26	medium	1,298	medium	1,156
4	Acquire data (C1)	7	20	medium	471	medium	426
5	Create/update data (C6)	7	16	high	1,112	medium	1,018
6	Validate data (C3)	7	14	high	571	medium	502
7	Collect field data electronically (B2)	7	12	high	594	medium	534
8	Create reports (G2)	7	9	medium	525	medium	482
9	Convert data (C9)	7	8	high	356	medium	317
10	Organize data (C2)	6	15	medium	824	medium	734
11	Maintain equipment & supplies (F8)	6	15	medium	727	low	624
12	Import/Export data (C5)	6	12	medium	344	medium	303
13	Participate in conferences/workshops (H2)	6	12	medium	691	low	628
14	Create/update metadata (C7)	6	11	high	510	medium	448
15	Provide training (H3)	6	11	medium	434	medium	396
16	Develop & make presentations (G4)	6	10	medium	434	medium	370
17	Evaluate data (A6)	6	9	high	272	medium	252
18	Evaluate data sources (A7)	6	6	high	318	medium	293
19	Coordinate project activities (F1)	5	14	high	62	high	60
20	Disseminate products (G5)	5	14	medium	306	medium	277
21	Georeference data (C8)	5	10	high	773	medium	703
22	Communicate with others (H1)	5	10	high	321	low	290
23	Define data requirements (A1)	5	9	medium	213	medium	194
24	Back-up/restore data (C4)	5	7	medium	351	low	311
25	Attend training (H5)	5	7	medium	484	low	437
26	Conduct geostatistical analysis (D5)	5	6	medium	218	medium	196
27	Develop project timeline/schedule (F6)	5	6	medium	173	medium	158
28	Review job related information (H9)	5	6	medium	262	medium	238

Table 1 (cont.)

GIS Technician Task Competencies – Tier 7 (Summary)

Ranked by Consensus among DACUM Panels and Complexity

#	*Task Categories*	*DACUM Panels*	Aggregate *Related Tasks*	Validation Survey (median) *Importance*	#	*Learning Difficulty*	#
29	Develop software applications (E2)	4	13	medium	246	high	225
30	Design/edit databases (E1)	4	9	high	45	high	44
31	Maintain software (E5)	4	8	high	38	medium	36
32	Perform queries (D2)	4	6				
33	Digitize data (B4)	4	5	high	331	low	301
34	Geocode data (B5)	4	5	high	380	medium	333
35	Define software/hardware requirements (E3)	4	5	medium	30	medium	28
36	Promote / represent GIS (H7)	4	5	medium	151	medium	145
37	Provide technical support (H8)	4	4	medium	129	medium	118
38	Prepare/assess cost estimates (F5)	3	7	medium	29	medium	29
39	Identify client needs/deliverables (F7)	3	7				
40	Conduct network analysis (D3)	3	6	medium	740	medium	631
41	Create tables & charts (G3)	3	6	medium	210	medium	192
42	Optimize database performance (E4)	3	5	medium	281	medium	240
43	Develop user guides (H4)	3	5	medium	58	high	55
44	Define feature behavior (A3)	3	4	medium	162	high	144
45	Conduct image analysis (D4)	3	4	medium	29	high	28
46	Develop data maintenance schedule (A4)	3	3	high	30	medium	28
47	COGO legal descriptions (B1)	3	3	medium	254	medium	227
48	Scan non-digital data (B6)	3	3	medium	305	low	277
49	Supervise interns (H10)	3	3	medium	112	medium	97
50	Determine project scope (F2)	3	3	low	173	medium	157
51	Determine resource requirements (F3)	2	4				
52	Join & relate data (A2)	2	3	high	436	medium	397
53	Establish data custodianships (A5)	2	3	medium	47	medium	45
54	Collect field data manually (B3)	2	3	medium	335	low	284
55	Acquire professional certification (H6)	2	2	medium	256	medium	225

Task ranking is by number of DACUM panels followed by aggregate number of related tasks.

Task categories are not mutually exclusive. Some categories may also be part of another more general category.

National Geospatial Technology Center, 2010

Table 2
GIS Technician Task Competencies - Tier 7 (Detail)
Ranked by Consensus among DACUM Panels and Complexity

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
1. Design & create maps (G1)	**8**	**34**	**medium**	**846**	**medium**	**785**
1. Acknowledge contributors						
2. Acknowledge contributors and copyrights						
3. Adhere to purpose and use of maps						
4. Apply cartographic conventions						
5. Calculate scale transformations.						
6. Conceptualize scale.						
7. Create graphic items (e.g. logos, headers, posters, exhibits) (E,C)						
8. Create interactive maps (82%) (Adv.)						
9. Create map series templates						
10. Create map templates (C)						
11. Create Maps						
12. Create maps (E,C)						
13. Create reference maps (e.g. streets)						
14. Create static maps						
15. Create thematic maps (e.g. zoning)						
16. Define purpose and use of maps						
17. Design Cartographic Elements						
18. Design layout						
19. Design layout						
20. Design map layouts						
21. Design Maps						
22. Determine appropriate fonts and colors						
23. Determine appropriate scale						
24. Determine appropriate scale and projection						
25. Determine appropriate symbology						
26. Interpret maps.						
27. Make project maps						
28. Perform Graphic Design						
29. Plot Map						
30. Recognize cartographic conventions						
31. Resolve spatial conflicts.						
32. Select proper media/output device						
33. Select proper media/output device						
34. Use appropriate symbology.						
2. Develop/document procedures (F4)	**8**	**13**	**medium**	**296**	**medium**	**265**
1. Assess documentation needs						
2. Complete Company documentation						
3. Conform to policies and standards						
4. Create documentation						
5. Develop GIS procedures (e.g. to update data)						
6. Develop policy for sharing data						
7. Develop procedural guides						
8. Document operating procedures						
9. Document Project Results						
10. Document what you have done for next person.						
11. Establish project standards (e.g. layout & format consistency)						
12. Maintain project documentation						
13. Produce in-house standardized data documentation.						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
3. Conduct geoprocessing (D1)	**7**	**26**	**medium**	**1,298**	**medium**	**1,156**

1. Assess output to determine if output is good.
2. Automate Manual Processes (e.g. scripting, modal building)
3. Calculate defined yield
4. Combine data layers
5. Compare data layers
6. Conduct Geoprocessing (e.g. clip, buffering, overlay, run models) (C)
7. Conduct slope analysis
8. Create Models (e.g. process & scientific models, flow charts) (C)
9. Create recommendation equations
10. Derive new data (e.g. generate contours from DEM, data generalization)
11. Geoprocess data (e.g. clip, buffer, union)
12. Identify service area
13. Interpolate defined yield
14. Interpolate point data
15. Interpret Results (C)
16. Interpret topography (i.e., contour lines).
17. Observe data anomalies
18. Perform buffer analysis
19. Perform overlay analysis.
20. Perform proximity analysis
21. Perform site selection
22. Perform vector/raster overlay analysis
23. Perform view shed analysis
24. Pre-process Data (e.g. generalize, subset) (C)
25. QA/QC Data (C) (Spatial/Non-Spatial Analysis)
26. Report data anomalies

4. Acquire data (C1)	**7**	**20**	**medium**	**471**	**medium**	**426**

1. Acquire Data
2. Acquire data from originator
3. Acquire existing data (e.g. digital, hard copy)
4. Acquire existing geospatial data
5. Adhere to P&P for sharing and receiving data
6. Adhere to policies for sharing and receiving data
7. Assist in determining data needs/format
8. Contact data originator for acquisition
9. Coordinate data collection
10. Define data collection methods (e.g. GPS, air photo)
11. Gather data for updates
12. Gather data for updates
13. Obtain agronomic data (e.g. soil test, yield)
14. Obtain area of interest boundary data
15. Obtain base map data (e.g. roads, streams, political boundaries, cities)
16. Obtain climate data (e.g. precipitation, wind, temperature)
17. Obtain imagery data (e.g. satellite, aerial)
18. Obtain land use data
19. Obtain terrain feature data (e.g. soil type, topography)
20. Purchase new data

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
5. Create/update data (C6)	**7**	**16**	**high**	**1,112**	**medium**	**1,018**
1. Create features						
2. Create subset data						
3. Edit attribute data						
4. Edit feature geometry						
5. Edit GIS data (e.g. add, delete, update) (E,C)						
6. Edit spatial data						
7. Enter data base information						
8. Match location points with attributes						
9. Perform spatial and content updates						
10. Perform spatial and content updates						
11. Populate GIS feature attributes (E,C)						
12. Post / reconcile edits (e.g. changes)						
13. Refresh/ replace layers (e.g. imagery, thematic layers) (C)						
14. Update Existing Data						
15. Update non-spatial data attributes						
16. Update spatial data attributes						
6. Validate data (C3)	**7**	**14**	**high**	**571**	**medium**	**502**
1. Finalize data sets						
2. Validate agronomic data						
3. Validate boundary data						
4. Determine data consistencies						
5. Verify that updates are error free						
6. Ensure Data Quality (Quality Control, Quality Assurance)						
7. Conduct Ground Truthing						
8. Validate spatial data (e.g. topology, build, verification)						
9. Validate tabular data						
10. Quality Assurance / Quality Control (Adv.) (Maintain data)						
11. Validate data changes (multi-editor environ.) (91%) (Adv.)						
12. QA/QC data (E,C) (Maintain GIS Data)						
13. Verify content and spatial accuracies						
14. Verify accuracy of imported data						
7. Collect field data electronically (B2)	**7**	**12**	**high**	**594**	**medium**	**534**
1. Assess current technologies used in data collection.						
2. Capture spatial & attribute data						
3. Capture spatial and non-spatial data						
4. Collect data using GPS						
5. Collect field attribute data (E,C)						
6. Collect field location data via GPS (E,C)						
7. Coordinate geodedic control prior to mapping						
8. Electronically collect field spatial data (GPS, Traffic counters, total station, yield monitors)						
9. Participate in geodetic control						
10. Perform Data Entry (e.g. college GPSdata, collect field data)						
11. Post process GPS data (e.g. differential correction)						
12. Post-process electronically collected field data (73%) (Adv.)						
8. Create reports (G2)	**7**	**9**	**medium**	**525**	**medium**	**482**
1. Create analysis reports (E,C)						
2. Create data analysis reports (e.g. tables, charts)						
3. Create Database Reports						
4. Create project status report						
5. Create reports (91%)						
6. Generate field reports e.g. budget, input quantities						
7. Report Results						
8. Report results						
9. Write informational reports (e.g. progress, technical, procedural, recommendations) (C)						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
9. Convert data (C9)	**7**	**8**	**high**	**356**	**medium**	**317**
1. Conversion of digital formats - data abstraction (cut, simplify, stretch & fit)						
2. Convert between data formats (C)						
3. Convert data between formats (e.g. KML, XML, RSS) (Adv.)						
4. Convert data into consistent formats						
5. Convert Data Source (e.g. Auto-CAD)						
6. Convert raw data into format of choice						
7. Perform data conversions						
8. Perform data conversions (between formats) (E, C)						
10. Organize data (C2)	**6**	**15**	**medium**	**824**	**medium**	**734**
1. Assist other team members in organizing their work.						
2. Categorize data						
3. Create directory structure						
4. Create naming conventions						
5. Establish file structure (Adv.)						
6. Make decisions to organize work priorities in light of unexpected contingencies.						
7. Normalize data structure (e.g. schema)						
8. Organize digital data (e.g. data library)						
9. Organize file structure (e.g. create directories, perform data & directory housekeeping (C)						
10. Organize files according to Company procedures						
11. Organize files.						
12. Organize non-digital data						
13. Organize work tasks.						
14. Organize written information (i.e., reports, resumes).						
15. Perform file management						
11. Maintain equipment & supplies (F8)	**6**	**15**	**medium**	**727**	**low**	**624**
1. Comply with company P&P						
2. Comply with hardware maintenance agreements						
3. Cooperate in using shared equipment						
4. Maintain equipment/ supplies) (E,C)						
5. Maintain GPS & field equipment (digital camera, laser range finder, DMI)						
6. Maintain Hardware						
7. Maintain inventory of supplies						
8. Maintain plotter / printer						
9. Maintain Plotters and Printers						
10. Maintain scanner						
11. Maintain Vehicle						
12. Monitor supplies inventories						
13. Order Supplies						
14. Request equipment & supplies (e.g. hardware, software)						
15. Schedule Equipment						
12. Import/Export data (C5)	**6**	**12**	**medium**	**344**	**medium**	**303**
1. Bulk load data and transfer formats.						
2. Communicate with other database						
3. Connect to external data sources (e.g. odbc, GIS servers)						
4. Export application recommendation files						
5. Export data in transferable format						
6. Export data in transferable format						
7. Export data structures						
8. Import CAD files (82%)						
9. Import data into appropriate formats						
10. Import data into existing GIS						
11. Import obtained data						
12. Integrate data from various sources into consistent format						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
13. Participate conferences/workshops (H2)	**6**	**12**	**medium**	**691**	**low**	**628**
1. Attend User Conferences						
2. Network with industry professionals						
3. Network with other job related professionals						
4. Participate in GIS user groups (E,C)						
5. Participate in job related professional organizations						
6. Participate in job related workshops						
7. Participate in professional conferences (oral, posters, publish/ submit articles) (E,C)						
8. Participate in professional organizations						
9. Participate in User Groups						
10. Participate in workshops & conferences						
11. Present at User Conferences (55%) (Adv.)						
12. Visit trade shows						
14. Create/update metadata (C7)	**6**	**11**	**high**	**510**	**medium**	**448**
1. Create / update metadata						
2. Create and maintain metadata						
3. Create and Update Meta Data						
4. Create metadata						
5. Create metadata						
6. Create metadata (E,C)						
7. Document spatial and content changes						
8. Initiate metadata process						
9. Publish metadata						
10. Update Metadata						
11. Update metadata (E,C)						
15. Provide training (H3)	**6**	**11**	**medium**	**434**	**medium**	**396**
1. Assess level of user's knowledge and needs and train accordingly						
2. Cross-train within organization (C)						
3. Cross-training (e.g. mentoring, coaching)						
4. Establish and maintain remote training sites						
5. Organize Staff/Department Training						
6. Participate in peer training						
7. Provide post training support						
8. Provide training						
9. Train co-workers						
10. Train GIS end-user(s) (C)						
11. Train Other Staff						
16. Develop & make presentations (G4)	**6**	**10**	**medium**	**434**	**medium**	**370**
1. Create animation (e.g. 3D, 4D)						
2. Create Presentation Materials						
3. Create Presentation Materials						
4. Create project presentation(s)						
5. Develop presentations						
6. Give Informational Presentations						
7. Present completed products						
8. Present project summary						
9. Provide information presentations						
10. Provide information presentations for users						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
17. Evaluate data (A6)	**6**	**9**	**high**	**272**	**medium**	**252**
1. Choose data for analysis						
2. Determine data compatibility (e.g. projections) (E,C)						
3. Evaluate data in context of application.						
4. Evaluate data quality.						
5. Evaluate spatial data accuracy						
6. Handle data types appropriately						
7. QA/QC data (E,C) (Create/Acquire GIS Data)						
8. Verify accuracy of imported data						
9. Verify content and spatial accuracies						
18. Evaluate data sources (A7)	**6**	**6**	**high**	**318**	**medium**	**293**
1. Evaluate data sources						
2. Evaluate sources						
3. Identify data sources/resources						
4. Research available data (C)						
5. Research Data Sources						
6. Research existing geospatial data						
19. Coordinate project activities (F1)	**5**	**14**	**high**	**62**	**high**	**60**
1. Assure QA/QC						
2. Conform to policy and standards						
3. Coordinate GIS projects (C)						
4. Coordinate multiple activities						
5. Coordinate multiple projects and ongoing activities						
6. Coordinate Projects with Stakeholders						
7. Coordinate with Information Technology (IT)						
8. Coordinate with Project Team						
9. Coordinate work with Consultants						
10. Maintain contracts (E)						
11. Make project recommendations						
12. Monitor project progress						
13. Produce application recommendation files						
14. Verify that project goals were met						
20. Disseminate products (G5)	**5**	**14**	**medium**	**306**	**medium**	**277**
1. Deliver Maps and Data						
2. Disseminate documentation						
3. Disseminate documentation where appropriate						
4. Disseminate information through a web site						
5. Disseminate information via Internet						
6. Distribute data according to organizational policy (E,C)						
7. Distribute digital products (E,C)						
8. Distribute hard copy products (E,C)						
9. Load/Burn Data onto Media						
10. Manage Web Content						
11. Produce deliverables						
12. Publish digital spatial information (CD, DVD)						
13. Publish Map Products						
14. Publish spatial information on-line						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
21. Georeference data (C8)	**5**	**10**	**high**	**773**	**medium**	**703**
1. Apply appropriate projections						
2. Change data's spatial reference						
3. Define data's spatial reference						
4. Georeference data						
5. Georeference data						
6. Georeference digital imagery (C)						
7. Georeference imagery						
8. Rectify images (C)						
9. Rectify raster data (e.g. rubbersheeting)						
10. Transform spatial data (e.g. reprojections)						
22. Communicate with others (H1)	**5**	**10**	**high**	**321**	**low**	**290**
1. Communicate quality control problems to other team members.						
2. Communicate with clients						
3. Communicate with co-workers						
4. Communicate with peers						
5. Communicate with peers						
6. Correspond with others (e.g. email, mail, phone) (C)						
7. Inform data users and custodians of update completion						
8. Interact with co-workers						
9. Let users & data custodians know that updates are completed						
10. Present ideas clearly and concisely.						
23. Define data requirements (A1)	**5**	**9**	**medium**	**213**	**medium**	**194**
1. Define data requirements (C)						
2. Define data requirements (e.g. domains)						
3. Determine appropriate projections						
4. Determine coverages to be managed						
5. Determine data needs / format						
6. Determine data to be obtained						
7. Determine future uses for completed project data / processes						
8. Determine future uses for completed projects/databases						
9. Determine resource needs						
24. Back-up/restore data (C4)	**5**	**7**	**medium**	**351**	**low**	**311**
1. Archive / retrieve data (E,C)						
2. Archive data						
3. Backup / restore data (E,C)						
4. Back-up Data						
5. Back-up finished project files						
6. Back-up raw data						
7. Implement database backup procedures						
25. Attend training (H5)	**5**	**7**	**medium**	**484**	**low**	**437**
1. Attend training						
2. Complete job related classes (online / classroom)						
3. Conduct self-assessment						
4. Evaluate personal performance						
5. Maintain technical proficiency						
6. Seek additional training						
7. Take advanced training courses (e.g. technical training & education courses) (C)						
26. Conduct geostatistical analysis (D5)	**5**	**6**	**medium**	**218**	**medium**	**196**
1. Analyze data statistically						
2. Apply principles of computational geometry.						
3. Generate statistical reports						
4. Generate statistics (e.g. descriptive, spatial) (C)						
5. Perform statistical analysis						
6. Use random sampling techniques.						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
27. Develop project timeline/schedule (F6)	**5**	**6**	**medium**	**173**	**medium**	**158**
1. Conform to project timetables						
2. Determine project timeline						
3. Develop project schedule						
4. Develop project timetables						
5. Estimate Task Schedule						
6. Prioritize Work Load						
28. Review job related information (H9)	**5**	**6**	**medium**	**262**	**medium**	**238**
1. Explore new process techniques						
2. Read trade publications						
3. Research current/emerging trends (e.g. publications, on-line)						
4. Research GIS Technology Trends						
5. Review industry publications						
6. View job related information (e.g. blogs, news feeds, print publications, forums)						
29. Develop software applications (E2)	**4**	**13**	**medium**	**246**	**high**	**225**
1. Automate Manual Processes						
2. Automate repetitive tasks (Adv.)						
3. Create scripts (C)						
4. Customize commercial software (C)						
5. Design application						
6. Determine application design format (e.g. platform, language)						
7. Determine programming tools required to develop applications						
8. Develop application to simplify and/or standardize procedures						
9. Develop software applications						
10. Enhance existing custom applications						
11. Exercise quality control (Application Dev't)						
12. QA/QC software applications (e.g. beta test) (C)						
13. Test application performance						
30. Design/edit databases (E1)	**4**	**9**	**high**	**45**	**high**	**44**
1. Construct a data base						
2. Create data dictionary						
3. Create Database Tables						
4. Define database fields						
5. Define database tables						
6. Design Database Structure						
7. Determine key fields						
8. Develop databases (e.g. define geometry & attributes)(C)						
9. Maintain Data Dictionaries						
31. Maintain software (E5)	**4**	**8**	**high**	**38**	**medium**	**36**
1. Comply with software licensing agreements						
2. Install Software (e.g. enhancements, service packs) (C)						
3. Install software upgrades						
4. Maintain Software						
5. Maintain workstation security						
6. Recommend software upgrades						
7. Support application						
8. Update and maintain application						
32. Perform queries (D2)	**4**	**6**				
1. Create Database Queries						
2. Perform basic spatial queries						
3. Perform data queries.						
4. Perform spatial database queries						
5. Respond to Geographic Queries						
6. Run Database Queries and Calculations						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
33. Digitize data (B4)	**4**	**5**	**high**	**331**	**low**	**301**
1. "Heads-up" digitize data						
2. Digitize feature geometry						
3. Perform “heads-up” (on-screen) digitization (E,C)						
4. Perform Data Entry (e.g. digitize geographic features, create Auto-Cad)						
5. Perform tablet digitization (E,C)						
34. Geocode data (B5)	**4**	**5**	**high**	**380**	**medium**	**333**
1. Geocode (Adv)						
2. Geocode addresses						
3. Geocode data (E, C)						
4. Perform Geo-coding						
5. Reverse geocode (82%) (Adv)						
35. Define software/hardware requirements (E3)	**4**	**5**	**medium**	**30**	**medium**	**28**
1. Define user software needs (C)						
2. Determine hardware /software requirements/ constraints						
3. Provide Technology Recommendations						
4. Recommend new technologies						
5. Select database software (performance, usability, cost, manageability, uses, output format)						
36. Promote / represent GIS (H7)	**4**	**5**	**medium**	**151**	**medium**	**145**
1. Educate and Promote GIS Capabilities						
2. Participate in public relations activities (E,C)						
3. Perform Community outreach						
4. Promote GIS uses						
5. Represent GIS at meetings (committees, user groups, organizational conferences) (E,C)						
37. Provide technical support (H8)	**4**	**4**	**medium**	**129**	**medium**	**118**
1. Provide Technical Support						
2. Provide technical support for users (Adv.)						
3. Resolve user technical problems (C)						
4. Troubleshoot hardware/software problems						
38. Prepare/assess cost estimates (F5)	**3**	**7**	**medium**	**29**	**medium**	**29**
1. Assess acquisition costs						
2. Assess maintenance & update cost						
3. Assess project costs						
4. Budget project						
5. Meet project budget						
6. Obtain data acquisition cost quotes						
7. Prepare cost estimates (e.g. time, equipment) (C)						
39. Identify client needs/deliverables (F7)	**3**	**7**				
1. Assess client need						
2. Assess client needs						
3. Assist in defining deliverables (maps, reports,…)						
4. Define deliverables						
5. Determine project needs						
6. Gather User Requirements						
7. Respond to Public Records Request						
40. Conduct network analysis (D3)	**3**	**6**	**medium**	**740**	**medium**	**631**
1. Identify least-cost path						
2. Identify shortest route						
3. Linear reference data						
4. Model linear networks						
5. Perform dynamic segmentation (18%) (Adv.)						
6. Perform network analysis (dynamic segmentation)						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
41. Create tables & charts (G3)	**3**	**6**	**medium**	**210**	**medium**	**192**
1. Create charts (82%)						
2. Create charts (E,C)						
3. Create Database Tables						
4. Create Mail Lists						
5. Create tables (E,C)						
6. Generate mailing labels (E,C)						
42. Optimize database performance (E4)	**3**	**5**	**medium**	**281**	**medium**	**240**
1. Conduct database performance tuning (e.g. compress, build stats, index) (C)						
2. Optimize data file folders (Adv.)						
3. Optimize data files (Adv.)						
4. Optimize database structure (Adv.)						
5. Optimize workstation performance						
43. Develop user guides (H4)	**3**	**5**	**medium**	**58**	**high**	**55**
1. Build help files						
2. Create "read me" files						
3. Develop training applications and course materials						
4. Develop users guides						
5. Write Technical Guides (C)						
44. Define feature behavior (A3)	**3**	**4**	**medium**	**162**	**high**	**144**
1. Build topology.						
2. Create topology for related features (64%) (Adv.)						
3. Define feature behaviors (e.g. sub-types & domains) (C)						
4. Define feature relationships/behaviors (relate tables, relationship classes)						
45. Conduct image analysis (D4)	**3**	**4**	**medium**	**29**	**high**	**28**
1. Classify remote sensing data						
2. Develop orthophotography						
3. Interpret Imagery						
4. Perform image analysis (e.g. classification) (C)						
46. Develop data maintenance schedule (A4)	**3**	**3**	**high**	**30**	**medium**	**28**
1. Conform to data maintenance schedule						
2. Develop a data maintenance schedule						
3. Develop data maintenance schedules						
47. COGO legal descriptions (B1)	**3**	**3**	**medium**	**254**	**medium**	**227**
1. COGO (55%)						
2. COGO legal descriptions (E)						
3. Digitize data using COGO (e.g. metes & bounds)						
48. Scan non-digital data (B6)	**3**	**3**	**medium**	**305**	**low**	**277**
1. Scan hard copy images (E, C)						
2. Scan hard copy maps						
3. Scan non-digital data (91%)						
49. Supervise interns (H10)	**3**	**3**	**medium**	**112**	**medium**	**97**
1. Participate in Hiring and Supervisory Activities						
2. Supervise interns (82%) (Adv.)						
3. Supervise Interns (C)						
50. Determine project scope (F2)	**3**	**3**	**low**	**173**	**medium**	**157**
1. Determine scope of project						
2. Develop Project Plan						
3. Develop project scope						
51. Determine resource requirements (F3)	**2**	**4**				
1. Allocate internal / external resource needs (equipment, personnel, data)						
2. Determine resource needs (equipment, personnel, data)						
3. Maintain project resources						
4. Optimize resources						

Competency	DACUM Panels	Aggregate Related Tasks	Validation Survey (median) Importance	#	Learning Difficulty	#
52. Join & relate data (A2)	**2**	**3**	**high**	**436**	**medium**	**397**
1. Join non-spatial data						
2. Join tables (e.g. link, join, relate)						
3. Perform spatial join						
53. Establish data custodianships (A5)	**2**	**3**	**medium**	**47**	**medium**	**45**
1. Assign data/database permissions						
2. Establish data custodianship (C)						
3. Establish the data custodianships						
54. Collect field data manually (B3)	**2**	**3**	**medium**	**335**	**low**	**284**
1. Administer questionnaires (27%)						
2. Collect data using field sheets						
3. Manually collect attribute data in the field (82%)						
55. Acquire professional certification (H6)	**2**	**2**	**medium**	**256**	**medium**	**225**
1. Acquire GIS Certification (45%)						
2. Obtain professional certification (e.g. GISP, ASPRS)						

Task ranking is by number of DACUM panels followed by aggregate number of related tasks.

Task categories are not mutually exclusive. Some categories may also be part of another more general category.

National Geospatial Technology Center, 2010

Table 3

GIS Technician: Priority Knowledge & Skill Competencies – Tier 6 (Summary)
Ranked by Consensus among DACUM Panels and Complexity

#	Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
1	Communication: verbal/presentation/writing (2)	8	23	medium	753
2	Critical thinking/Problem Solving (10)	7	13	high	318
3	Organizational (24)	7	11	high	343
4	Mathematics (geometry, statistics) (23)	7	9	medium	391
5	Time management (32)	7	7	high	291
6	Cartography (1)	6	8	medium	416
7	Computer programming (7)	6	6	medium	280
8	Computer basics (3)	5	12	medium	311
9	Computer database (4)	5	12	medium	253
10	Land divisions, measurements (20)	5	11	medium	511
11	Photogrammetry/Remote Sensing (25)	5	8	medium	264
12	Computer software (8)	5	7	medium	331
13	Map reading (22)	5	5	high	228
14	Troubleshooting (33)	5	5	high	238
15	Industry applications (18)	4	11	medium	264
16	Data types, transfers & conversions (12)	4	8	high	628
17	Geography (15)	4	7		
18	Standards (client, customer, industry) (30)	4	7	medium	594
19	Coordinate systems, projections (9)	4	6	high	235
20	Computer keyboarding (5)	4	4	medium	237
21	Scale (28)	4	4	high	237
22	Geoprocessing, modeling (16)	3	6	medium	512
23	Data models (11)	3	5	high	157
24	Jargon, acronyms (19)	3	4	medium	155
25	Research (27)	3	4	medium	155
26	Computer networks (6)	2	4	medium	52
27	Equipment operation (14)	2	4	medium	155
28	Engineering drawings (13)	2	3	medium	53
29	Spatial Thinking (29)	2	3	high	156
30	Units of measure/conversion (34)	2	3	medium	392
31	GPS (17)	2	2		
32	Queries & analysis (26)	2	2	medium	224
33	Web development (35)	1	3		
34	Legal issues (21)	1	2	medium	136
35	Teaching (31)	1	1		

Categories are not mutually exclusive. Some knowledge, skill and behavior categories may also be part of another more general category.
Source: National Geospatial Technology Center, 2010

Table 4

GIS Technician: Priority Behavior Competencies – Tier 6 (Summary)

Ranked by Consensus among DACUM Panels and Complexity

#	Behavior Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
1	Detail orientated (5)	8	10	high	371
2	Self-motivated / independent (24)	6	14	high	366
3	Team Player (26)	6	11	high	50
4	Analytical (2)	6	7	high	366
5	Punctual / reliable (21)	5	5	high	81
6	Multi-tasking (13)	4	4	high	209
7	Follow procedures (10)	3	5		
8	Positive attitude (18)	3	4	high	155
9	Self-improvement (23)	3	4	high	52
10	Ethical / respectful (9)	3	3	high	236
11	Industrious, persistent (11)	3	3		
12	Dress Code, etiquette, hygiene (7)	2	3	medium	76
13	Open minded (15)	2	3		
14	Outgoing, friendly (16)	2	3	medium	81
15	Trustworthy, honesty, integrity (27)	2	3	medium	519
16	Visionary (28)	2	3		
17	Adaptable, flexible (1)	2	2	high	52
18	Common sense (3)	2	2	high	237
19	Professionalism, maturity (20)	2	2		
20	Resourceful (22)	2	2	high	285
21	Sense of humor (25)	2	2	high	548
22	Networking (interpersonal) (14)	1	2		
23	Creative (4)	1	1	high	157
24	Diplomatic (6)	1	1	high	157
25	Enthusiastic (8)	1	1	high	157
26	Leadership (12)	1	1		
27	Patient (17)	1	1		

Ranking is by number of DACUM panels followed by aggregate number of related knowledge, skills & behaviors.

Categories are not mutually exclusive. Some knowledge, skill and behavior categories may also be part of another more general category.

Source: National Geospatial Technology Center, 2010

Table 5
GIS Technician: Priority Knowledge & Skill Competencies – Tier 6 (Detail)
Ranked by Consensus among DACUM Panels and Complexity

Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
1. Communication: verbal/presentation/writing (2)	**8**	**23**	**medium**	**753**
1. Business skills				
2. Communication				
3. Communication skills				
4. Communication skills (verbal & written)				
5. Communication skills (writing, reading)				
6. Communication skills -oral				
7. Communication skills -written, email				
8. Demonstrate ability to research information.				
9. Demonstrate active listening skills.				
10. Demonstrate initiative in communicating ideas.				
11. Demonstrate negotiation skills.				
12. Demonstrate oral communication skills (individual, group, team, client presentations).				
13. Demonstrate technical writing skills.				
14. Good written and verbal interpersonal communication skills				
15. Graphing & reporting				
16. Oral Communication				
17. People skills (public relations, communication)				
18. Presentation				
19. Printing legibly				
20. Technical writing				
21. Technical writing				
22. Verbal & written communication				
23. Verbal communication				
2. Critical thinking/Problem Solving (10)	**7**	**13**	**high**	**318**
1. “Think Outside the Box”, "See the big picture"				
2. Analytical thinker				
3. Break problem into manageable parts.				
4. Critical thinking				
5. Critical thinking				
6. Critical thinking				
7. Problem solve				
8. Problem solving				
9. Problem solving				
10. Problem solving skills				
11. Problem solving skills				
12. Recognize and define problem(s).				
13. Solution-orientated				
3. Organizational (24)	**7**	**11**	**high**	**343**
1. Demonstrate ability to maintain focus and be consistent.				
2. Demonstrate file management skills.				
3. Demonstrate neatness.				
4. Interpret and implement procedures methodically.				
5. Organization				
6. Organizational				
7. Organizational				
8. Organizational skills				
9. Organized				
10. Organized				
11. Organized				

Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
4. Mathematics (geometry, statistics) (23)	**7**	**9**	**medium**	**391**
1. Geometry				
2. Mathematics				
3. Mathematics				
4. Mathematics (geometry, statistics, trigonometry, algebra)				
5. Statistics				
6. Statistics				
7. Statistics				
8. Statistics				
9. statistics				
5. Time management (32)	**7**	**7**	**high**	**291**
1. Diversified task - time management				
2. Time management				
3. Time management				
4. Time management				
5. Time Management				
6. Time management skills				
7. Time management skills				
6. Cartography (1)	**6**	**8**	**medium**	**416**
1. Cartographic design				
2. Cartographic Design				
3. Cartographic license				
4. Cartographic principles/theory				
5. Cartography				
6. Create map book				
7. Demonstrate graphic design skills.				
8. Demonstrate map design and layout.				
7. Computer programming (7)	**6**	**6**	**medium**	**280**
1. Apply basic programming princi-ples (SQL statements, Boolean logic, macros).				
2. Basic scripting (SQL, VB, HTML, Python, ASP, CSS, Query)				
3. Experience with computer programming concepts				
4. Programming				
5. programming				
6. Programming languages (VBA)				
8. Computer basics (3)	**5**	**12**	**medium**	**311**
1. Apply basic concepts of hardware storage.				
2. Burn to disk				
3. Computer skills				
4. Computer skills (above average)				
5. Define and differentiate among computer terms related to networks.				
6. Demonstrate knowledge of basic computer concepts and terms.				
7. Demonstrate knowledge of graphical user interface environ-ment (i.e., Windows).				
8. FTP site				
9. Internet skills, esp. data collection and attribution				
10. Operating systems				
11. Use basic operating system commands.				
12. Use Internet, ftp, e mail, computer faxes.				
9. Computer database (4)	**5**	**12**	**medium**	**253**
1. Computer Science-database design				
2. Computer Science-information management				
3. Digital file management				
4. Database development				
5. Database administration				
6. Experience with relational databases				
7. Data custodianship				
8. Database structure				
9. Data exchange procedures				
10. Security restrictions on data				
11. Relational database design,				
12. file management				

Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Responses
10. Land divisions, measurements (20)	**5**	**11**	**medium**	**511**
1. Basic survey principles				
2. basics of surveying				
3. Cadastral data				
4. Coordinate geometry (COGO)				
5. Interpret legal descriptions				
6. Land measurements				
7. Land descriptions				
8. Land divisions				
9. Land surveying				
10. Legal descriptions				
11. Plats & deeds				
11. Photogrammetry/Remote Sensing (25)	**5**	**8**	**medium**	**264**
1. Geography-photogrammetry				
2. Geography-remote sensing				
3. Basic remote sensing theory				
4. Photogrammetry				
5. Remote sensing				
6. Thermal imaging				
7. Photogrammetry				
8. Remote sensing				
12. Computer software (8)	**5**	**7**	**medium**	**331**
1. Geography-competency in software				
2. Legacy technology				
3. Modify user interface				
4. End user Web applications				
5. Use software applications.				
6. Use various platforms.				
7. GIS software				
13. Map reading (22)	**5**	**5**	**high**	**228**
1. Cadastral				
2. Conceptualize images in 3 D.				
3. Good color sensitivity helpful				
4. Map interpretation				
5. Map reading				
14. Troubleshooting (33)	**5**	**5**	**high**	**238**
1. Geography-navigation/trouble shooting				
2. Troubleshooting				
3. Troubleshooting				
4. Troubleshooting				
5. Troubleshooting skills				
15. Industry applications (18)	**4**	**11**	**medium**	**264**
1. Demonstrate fundamental drafting skills.				
2. Drafting				
3. Engineering-survey				
4. Explain how GIS can be used in various real world applications.				
5. Fisheries				
6. Forestry basics/survey				
7. Geology				
8. Identify applications of GIS technology.				
9. Related Industries				
10. Variable Rate Technology (VRT)				
11. Wildlife				

Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
16. Data types, transfers & conversions (12) 1. Adding data to a project (GIS, CAD) 2. Data collection and format conversion **3.** Data manipulation (spatial, non-spatial) 4. Data sources 5. Data transfer 6. Export formats, properties; settings 7. File transfer **8.** File types (SHP, GDB, Coverage, CAD, DGN, TXT, IMG, TIF, SID, Flash, PDF, GeoPDF, e00, PkZIP, RAR, TAR	**4**	**8**	**high**	**628**
17. Geography (15) 1. Apply principles of geography. 2. Geographic principles **3.** Geography 4. Geography-Cartography 5. Geography-census 6. Geography-transportation **7.** Geography-urban planning	**4**	**7**		
18. Standards (client, customer, industry) (30) 1. "ISO 9000" standards 2. Client/company standards 3. GIS Industry standards 4. Naming conventions **5.** Quality control & assurance procedures 6. technological standards **7.** Understand national documentation standards	**4**	**7**	**medium**	**594**
19. Coordinate systems, projections (9) 1. Coordinate systems 2. Coordinate systems Projections 3. map datum, geoid 4. projections **5.** Recognize projections. **6.** Spatial projections	**4**	**6**	**high**	**235**
20. Computer keyboarding (5) 1. Data entry **2.** Demonstrate keyboarding skills. 3. Keyboarding **4.** Typing	**4**	**4**	**medium**	**237**
21. Scale (28) **1.** Demonstrate appropriate scale for message. 2. Map scale 3. Scale **4.** Scale	**4**	**4**	**high**	**237**
22. Geoprocessing, modeling (16) 1. Contour mapping 2. Create TIN model 3. Creating models 4. Evaluate a physical model. **5.** Explain how a data model works. **6.** Geoprocessing methods	**3**	**6**	**medium**	**512**
23. Data models (11) 1. Conceptualize model of reality. 2. Differentiate between raster space and real space. 3. Raster / Vector **4.** Raster and vector data **5.** Recognize raster and vector models.	**3**	**5**	**high**	**157**

Knowledge & Skill Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
24. Jargon, acronyms (19)	**3**	**4**	**medium**	**155**
1. Industry jargon				
2. Jargon				
3. Platform shop talk				
4. Technical terminology				
25. Research (27)	**3**	**4**	**medium**	**155**
1. Demonstrate ability to research information.				
2. Research technical support				
3. Research techniques				
4. Scientific methods				
26. Computer networks (6)	**2**	**4**	**medium**	**52**
1. Computer networking				
2. Computer, Network configuration				
3. Networking systems				
4. Windows networks				
27. Equipment operation (14)	**2**	**4**	**medium**	**155**
1. Application equipment capabilities/limitations				
2. Plotter operation				
3. Technical operating				
4. Understanding of equipment interactions				
28. Engineering drawings (13)	**2**	**3**	**medium**	**53**
1. Engineering-CAD				
2. Engineering-COGO				
3. Reading engineering-grade plans				
29. Spatial Thinking (29)	**2**	**3**	**high**	**156**
1. Demonstrate spatial intelligence.				
2. Recognize spatial inconsistencies.				
3. Spatial awareness				
30. Units of measure/conversion (34)	**2**	**3**	**medium**	**392**
1. Unit conversions				
2. Unit conversions				
3. Units of measure				
31. GPS (17)	**2**	**2**		
1. Global GPS system				
2. Global Positioning System (GPS)				
32. Queries & analysis (26)	**2**	**2**	**medium**	**224**
1. Interpolation				
2. Query (spatial/attribute)				
33. Web development (35)	**1**	**3**		
1. Relevant domain knowledge				
2. Web content management				
3. Web development				
34. Legal issues (21)	**1**	**2**	**medium**	**136**
1. Copyright laws				
2. OSHA requirements				
35. Teaching (31)	**1**	**1**		
1. Teaching skills				

Ranking is by number of DACUM panels followed by aggregate number of related knowledge, skills & behaviors.

Categories are not mutually exclusive. Some knowledge, skill and behavior categories may also be part of another more general category.

Source: National Geospatial Technology Center, 2010

Table 6

GIS Technician: Priority Behavior Competencies (Detail)
Ranked by Consensus among DACUM Panels and Complexity

Behavior Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
1. Detail orientated (5)	**8**	**10**	**high**	**371**
1. Attentive to detail				
2. Observant				
3. Detail orientated				
4. Attention to detail				
5. Detail orientated				
6. Accuracy & precision				
7. Detail oriented				
8. Detail-oriented				
9. Check work.				
10. Thoroughness				
2. Self-motivated / independent (24)	**6**	**14**	**high**	**366**
1. Ability to work independently				
2. Can work independently				
3. Independent				
4. Independent worker				
5. Motivated				
6. motivated				
7. Self motivation				
8. Self-disciplined				
9. Self-initiated learner				
10. Self-motivated				
11. Self-motivated				
12. Self-starter				
13. Self-starter				
14. Self-starter, independent worker				
3. Team Player (26)	**6**	**11**	**high**	**50**
1. Can work in team				
2. Demonstrate ability to work in a team as a member and/or leader.				
3. Interpersonal				
4. Networking				
5. Recognize roles of others in team and cooperate to get job done.				
6. Team building				
7. Team participation				
8. Team player				
9. Team player				
10. Team Player				
11. Team worker				
4. Analytical (2)	**6**	**7**	**high**	**366**
1. Analytical				
2. Analytical				
3. Analytical				
4. Analytical				
5. Analytical, detail oriented				
6. Interpret technical information (i.e., manuals and CD Rom)				
7. Logical, intelligent				
5. Punctual / reliable (21)	**5**	**5**	**high**	**81**
1. Consistent				
2. Punctual				
3. Punctuality				
4. Punctuality				
5. Reliable - punctual				

Behavior Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
6. Multi-tasking (13)	**4**	**4**	**high**	**209**
1. Ability to multi-task				
2. Able to multi-task, set work priorities				
3. Multi-tasking				
4. Multi-tasking				
7. Follow procedures (10)	**3**	**5**		
1. follow procedures				
2. Recognize the importance of following procedures.				
3. Follow technical procedures.				
4. Demonstrate data entry and digitizing skills.				
5. Understanding of copyright laws and standards				
8. Positive attitude (18)	**3**	**4**	**high**	**155**
1. Attitude				
2. Can-do, positive attitude				
3. Positive attitude				
4. Positive attitude				
9. Self-improvement (23)	**3**	**4**	**high**	**52**
1. Ability to learn				
2. Self-improvement				
3. Willingness to learn				
4. Willingness to learn				
10. Ethical / respectful (9)	**3**	**3**	**high**	**236**
1. Ethical				
2. Ethical behavior (integrity)				
3. Respectful of others				
11. Industrious, persistent (11)	**3**	**3**		
1. Demonstrate ability to be persistent at collecting data.				
2. Industrious				
3. Persistence				
12. Dress Code, etiquette, hygiene (7)	**2**	**3**	**medium**	**76**
1. Dress code				
2. Hygienic				
3. Use appropriate office etiquette				
13. Open minded (15)	**2**	**3**		
1. Open to new tasks, assignments, ideas				
2. Open-minded				
3. Open-minded				
14. Outgoing, friendly (16)	**2**	**3**	**medium**	**81**
1. Easy-going				
2. Outgoing (friendly)				
3. People skills				
15. Trustworthy, honesty, integrity (27)	**2**	**3**	**medium**	**519**
1. Honesty				
2. Integrity				
3. Trustworthy with confidential information				
16. Visionary (28)	**2**	**3**		
1. Abstract thinker (outside the box)				
2. Divine - all knowing				
3. Visionary				
17. Adaptable, flexible (1)	**2**	**2**	**high**	**52**
1. Adaptability				
2. Adaptable, Flexible				
18. Common sense (3)	**2**	**2**	**high**	**237**
1. Common sense				
2. Common sense				
19. Professionalism, maturity (20)	**2**	**2**		
1. maturity				
2. Professionalism				

Behavior Categories	DACUM Panels	Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Validation Survey (median) Responses
20. Resourceful (22)	**2**	**2**	**high**	**285**
1. Resourceful				
2. Resourcefulness				
21. Sense of humor (25)	**2**	**2**	**high**	**548**
1. Good sense of humor				
2. Sense of humor				
22. Networking (interpersonal) (14)	**1**	**2**		
1. Network with peers				
2. Participate outside of office (e.g. within user groups)				
23. Creative (4)	**1**	**1**	**high**	**157**
1. Creativity				
24. Diplomatic (6)	**1**	**1**	**high**	**157**
1. Diplomatic, tactful				
25. Enthusiastic (8)	**1**	**1**	**high**	**157**
1. Enthusiastic				
26. Leadership (12)	**1**	**1**		
1. Leadership skills				
27. Patient (17)	**1**	**1**		
1. Patient				

Ranking is by number of DACUM panels followed by aggregate number of related knowledge, skills & behaviors.

Categories are not mutually exclusive. Some knowledge, skill and behavior categories may also be part of another more general category.

Source: National Geospatial Technology Center, 2010