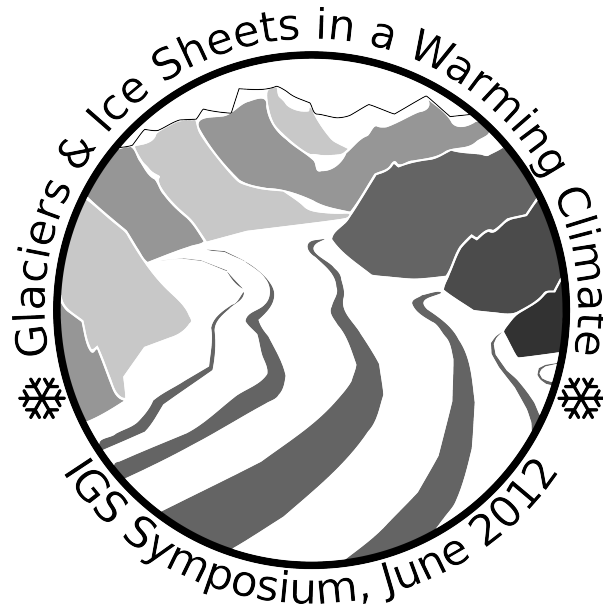


INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on Glaciers and ice sheets in a warming climate

**University of Alaska Fairbanks, Alaska, USA
24 - 29 June 2012**



Co-sponsored by:

University of Alaska Fairbanks (UAF), Vice Chancellor for Research
University of Alaska, Office of the Vice President for Academic Affairs & BP ConocoPhillips
United States Geological Survey (USGS), Alaska Science Center
University of Alaska Fairbanks (UAF), College of Natural Science and Mathematics
Arctic Research Consortium of the United States (ARCUS)
Geophysical Institute, University of Alaska Fairbanks (UAF)



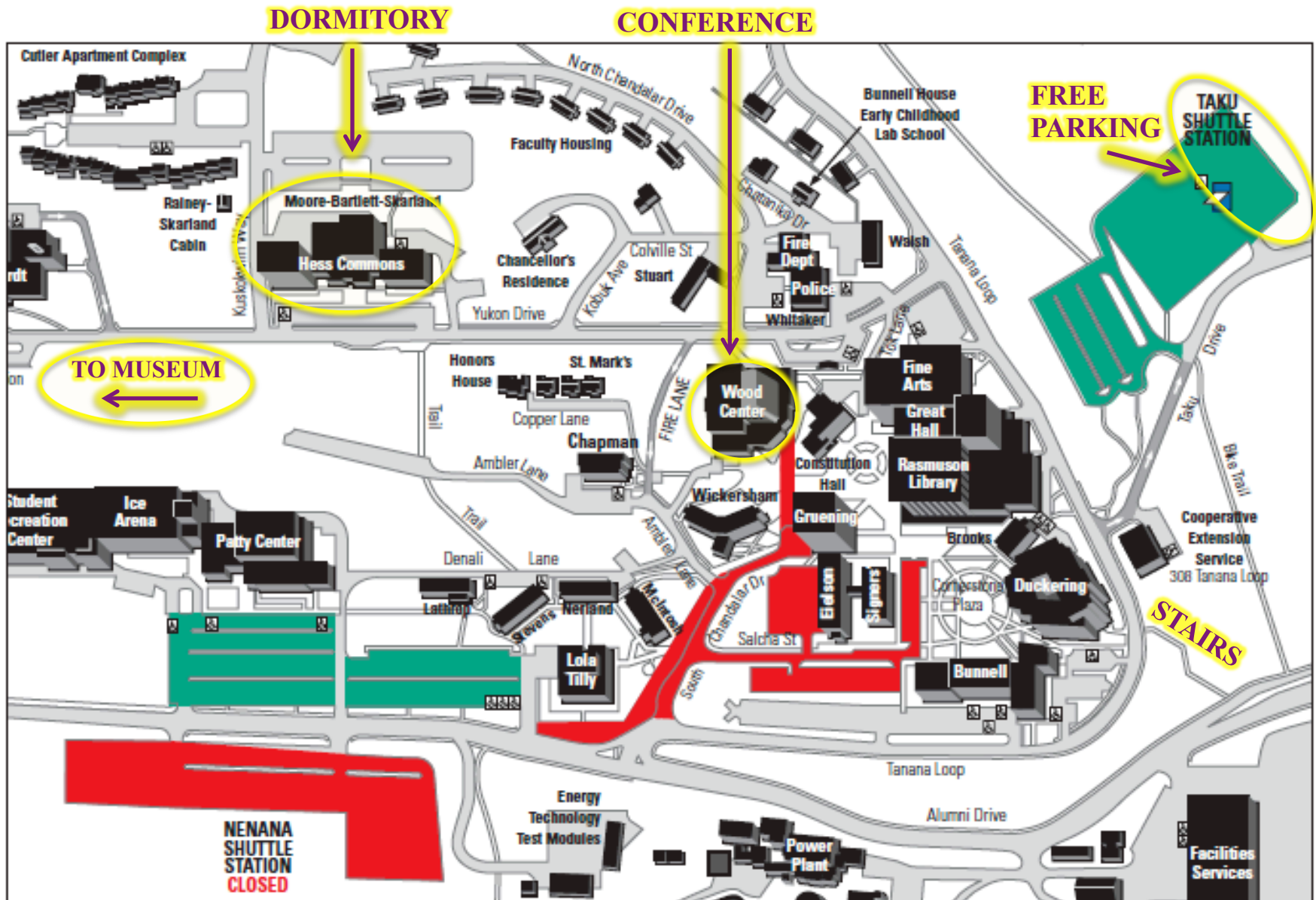
UNIVERSITY
of ALASKA
Many Traditions One Alaska



College of Natural Science & Mathematics

Program IGS Symposium, Fairbanks, Alaska, 24-29 June 2012

Time	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
9:00		Welcome	INVITED TALK	INVITED TALK	INVITED TALK	INVITED TALK
9:15		INVITED TALK				
9:30		Talks	Talks	Talks	Talks	Talks
9:45						
10:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:15						
10:30		Talks	Talks	Talks	Talks	Talks
10:45						
11:00		Annual General Meeting	Talks	Talks	Talks	Talks
11:15						
11:30		LUNCH 12:30 - 14:00	LUNCH 12:30 - 14:00	Pick up Sack Lunch	LUNCH 12:45 - 14:00	LUNCH 12:30 - 14:00
11:45						
12:00		Talks	Talks	Eat Lunch in Bus ----- Bus #1: Chena Hot Springs ----- Bus #2: Chena Hot Springs ----- Bus #3: Gold Mine/Poker Flats ----- Bus #4: Gold Mine/Permafrost Tunnel	Talks	Talks
12:15						
12:30		Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
12:45						
13:00		Talks	POSTER SESSION I	POSTER SESSION I	POSTER SESSION II	Talks
13:30						
14:00		APEX Early Career Forum	Seligman Crystal	BBQ on Museum Lawn 19:00 - 22:00	Banquet Riverboat Discovery Boarding begins at 18:30	
14:15						
14:30		Registration and Social at Wood Center Pub 17:00-22:00				
14:45						
15:00	Talks					
15:15						
15:30	Coffee Break					
15:45						
16:00	Talks					
16:15						
16:30	Talks					
16:45						
17:00	Talks					
17:15						
17:30	Talks					
17:45						
18:00	Talks					
18:30						
18:45	Talks					
19:00						
20:00	Talks					
21:00						
22:00	Talks					



OFF-CAMPUS SITES

- 1 Robert G. White Large Animal Research Station, Yankovich Road
- 2 Harper Building, 4280 Geist Road (Interior-Aleutians Campus)
- 3 West Valley Plaza, 4001 Geist Road
- 4 Wells Fargo Building, 794 University Ave.
- 5 Facilities Services Division of Design and Construction, 590 University Ave.
- 6 Denali Building, 3352 College Road
- 7 Administrative Services Center, 3295 College Road
- 8 Statewide Risk Management, 1760 Westwood Way
- 9 Central Receiving, Campus Mail Services, 1855 Marika Road
- 10 Poker Flat Research Range, 30 mile Steese Highway
- 11 CTC Cosmetology Program, 607 Old Steese Hwy. (Cornerstone Mall North), Suite C
- 12 Downtown Center, CTC, 510 Second Ave.
- 13 UAF Community and Technical College, 604 Barrette St.
- 14 Fire Station 2, 1950 University Ave. S.
- 15 West Side Business Park, 2175 University Ave. S. (Center for Distance Education, College of Rural and Community Development Bookstore, Statewide Office of Academic Affairs, Alaska Teacher Placement, Early Childhood Education, Math in a Cultural Context)
- 16 CTC Automotive Technology Center, 3202 Industrial Ave.
- 17 Fairbanks Pipeline Training Center, 3600 Cartwright Court

STUDENT SERVICES

- Academic Advising (Gruening Bldg.)... e-10
 Admissions (Signers' Hall)... e-10
 Business Office (Signers' Hall)... e-10
 Bookstore (Constitution Hall)... d-10
 Career Services (Eielson Bldg.)... e-10
 Developmental Education (Eielson Bldg.)... e-10
 Dining (Lola Tilly Commons)... f-9
 Disability Services (Whitaker Bldg.)... d-10
 Financial Aid (Eielson Bldg.)... e-10
 Graduate School (Eielson Bldg.)... e-10
 Health & Counseling (Whitaker Bldg.)... d-10
 Multicultural Affairs and Diversity (Eielson Bldg.)... e-10
 New Student Orientation (Wood Center)... d-9/10
 Polar Express (Eielson Bldg.)... e-10
 Registrar (Signers' Hall)... e-10
 Residence Life/Housing (MBS Complex)... c-8
 Rural Student Services (Brooks Bldg.)... e-11
 Student Center (Wood Center)... d-9/10
 Student Recreation Center... e-6
 Veterans' Services (Eielson Bldg.)... e-10
 Women's Center (Eielson Bldg.)... e-10
 Writing Center (Gruening Bldg.)... e-10

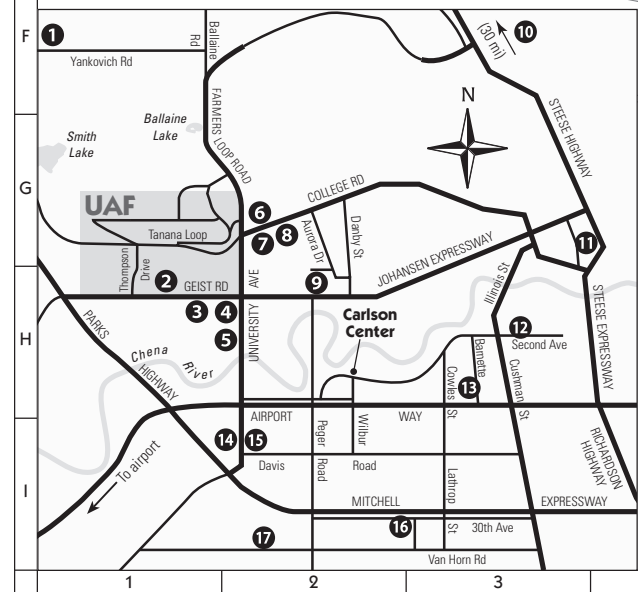
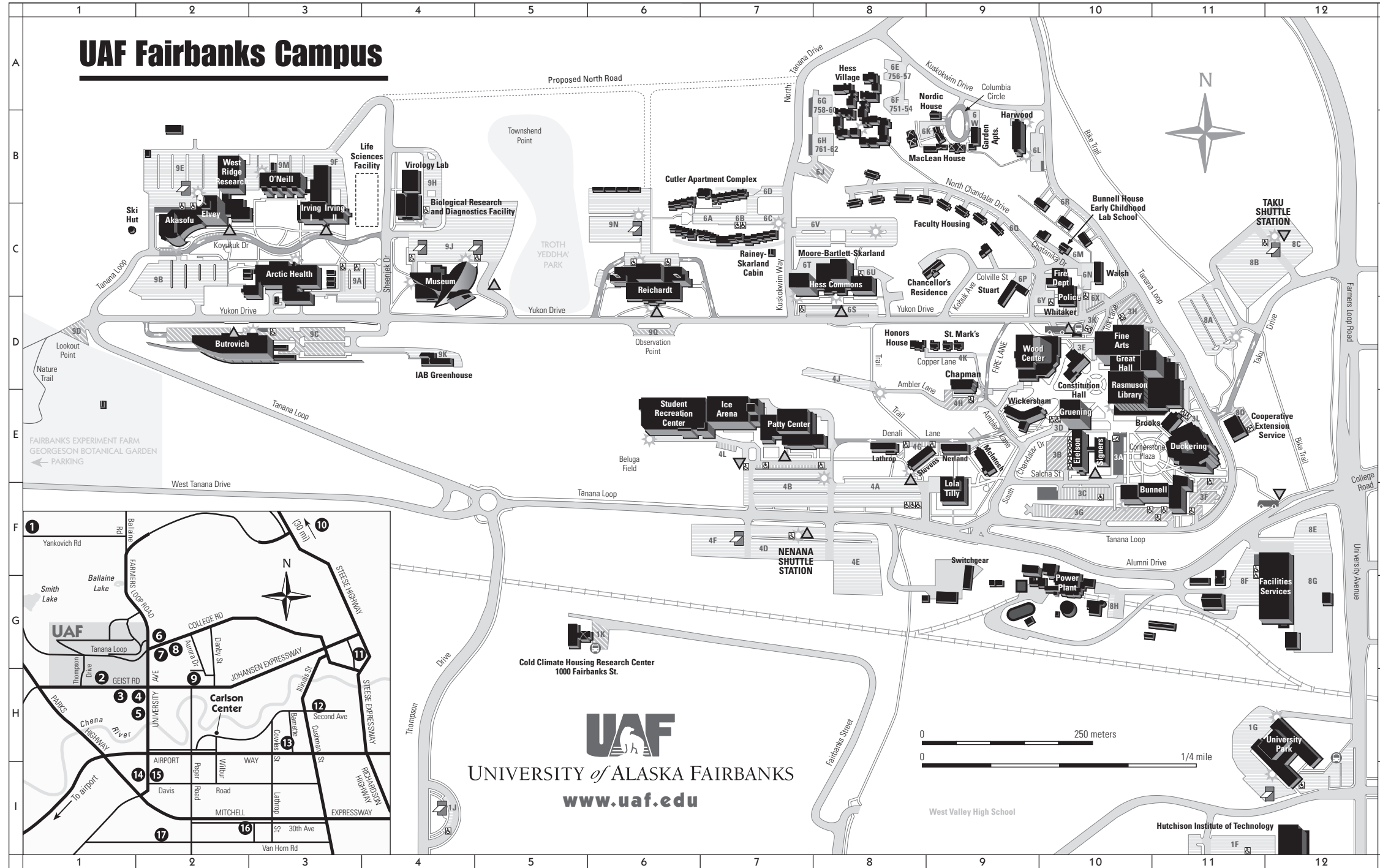
RESIDENCE HALLS AND HOUSING

- Bartlett Hall... c-8
 Cutler Apartment Complex... b/c-6/7
 Faculty Housing... b-8, c-9
 Garden Apartments... b-9
 Harwood Hall... b-9
 Hess Village... a/b-8
 Lathrop Hall... e-8
 MacLean House... e-8
 McIntosh Hall... e-9
 Moore Hall... c-7
 Nerland Hall... e-9
 Nordic House... e-9
 Skarland Hall... c-8
 Stevens Hall... e-8
 Stuart Hall... c-9
 Walsh Hall... c-10
 Wickershams Hall... e-9

BUILDINGS

- Akasofu Bldg. (International Arctic Research Center)... j-2
 Arctic Health Research Bldg... c-3
 Atkinson Bldg. (Power Plant)... g-10

UAF Fairbanks Campus



UAF
 UNIVERSITY of ALASKA FAIRBANKS
www.uaf.edu

Key

- Emergency phones
- One-way street
- Shuttle stops
- On-call shuttle stops
- Off-campus shuttle stops (call 474-RIDE)
- Borough bus stop (MACS)

Parking

- Visitors only, metered (8 a.m. - 5 p.m. M - F)
- Visitors and UAF-affiliated, metered (8 a.m. - 5 p.m. M - F)
- Visitors and UAF decal
- Gold decal only (7 a.m. - 5 p.m. M - F)
- UAF decal or purchased permit
- Restricted parking/No parking
- No parking unless otherwise posted
- Parking permit kiosk
- Handicap parking

Handicap parking permits are available through the Alaska Division of Motor Vehicles. For temporary campus handicap permits contact UAF Parking Services and present medical documentation.

For up-to-date parking information visit www.uaf.edu/parking/ or call 474-7275.

PARKING LOTS

Name	code	grid
Administrative Services, East	1A	g-2
Administrative Services, West	1B	g-2
Arctic Health, East	9A	c-3
Arctic Health, West	9B	c-2
Ballaine	8A	d-11
Biological Research	9H	b/c-4
Bunnell, East	3F	f-11
Bunnell, South	3G	f-10/11
Bunnell House	6M	c-10
Chapman	4H	d-9
Cold Climate Housing Research Center	1K	g-5
Constitution	3E	d-10
Cooperative Extension Service	8D	e-11
Copper Lane	4K	d-9
Cutler Apartment Complex	6A-D	b/c-6/7
Denali Lane	4G	e-8/9
Eielson, South (meters)	3C	f-10
Eielson, West	3B	e-10
Eveley	9E	b-2
Fine Arts	3H	d-10
Garden Apartments	6W	b-9
Greenhouse, IAB	9K	d-4
Gruening, West	3D	e-10
Haida	4J	d-8
Harper	1E	h-1
Harwood	6L	a/b-9
Hess Village	6E-H	a/b-8
Hutchinson	1F	i-11
Irving	9F	b-3
Library, East	8F	e-11
Lookout Point	9D	d-1
Lower Dorms	4A	f-8
MacLean House	6K	b-8/9
MBS East	6U	c-8
MBS North	6V	c-7/8
MBS South	6S	d-8
MBS West	6T	c-7/8
Museum of the North, UA	9J	c-4/5
Nenana	4D	f-7
Nenana, East	4E	f-8
Nenana, West	4F	f-7
North Chandalar	6Q	b/c-8/9
Observation Point	9Q	d-6
O'Neill, North	9M	b-3
O'Neill, South	9N	b-3
Patty Center/SRC	4B	e-11
Physical Plant, East	8G	f/g-12
Physical Plant, North	8E	f-12
Physical Plant, West	3K	f/g-11
Power Plant	8H	g-10
Reichardt	9N	c-6
Signers' (meters)	3A	e-10
Sheenjek	9G	b-4
Stuart	6P	c-9
Student Recreation Center	4L	e-7
Taku, East	8B	c-11/12
Taku, West	8C	c-12
Tanana Apartments	6R	c-10
Thompson Drive Pull-out	1J	i-4
University Park	1G	h/i-11/12
Virology Lab, State of Alaska	9H	b/c-4
Walsh Hall	6N	c-10
Whitaker, East (meters)	6X	c/d-10
Whitaker, West	6Y	c/d-10
Wood Center, East	3K	d-10
Administrative Services Center	g-2	
Akasofu Bldg.	c-2	
Arctic Health Research Bldg.	c-3	
Ballaine Parking Lot	d-11	
Bunnell Bldg.	f-10	
Butrovich Bldg.	d-3	
Chapman Bldg.	e-9	
Cutler Apartment Complex Parking Lot	c-7	
Haida Parking Lot	d/e-8	
Harwood Hall (2)	b-9	
Hess Commons	c/d-8	
Hess Village Recreation Center	b-8	
Moore Parking Lot	c-7	
Moore-Bartlett-Skarland Complex	c-8	
Museum of the North, UA (2)	c-4	
O'Neill Bldg.	b-3	
Patty Center Parking Lot	e-8	
Rasmuson Library	e-10	
Reichardt Bldg. (2)	c/d-6	
Stevens Hall	e-8	
Student Recreation Center	e-6	
University Park Parking Lot (2)	h/i-12	
Whitaker Bldg.	c-10	

EMERGENCY SERVICES

- Fire Station 1... c-10
- Fire Station 2... i-2
- Police... c/d-10

Places to eat within easy walking distance of Wood Center


















Get directions **My places**

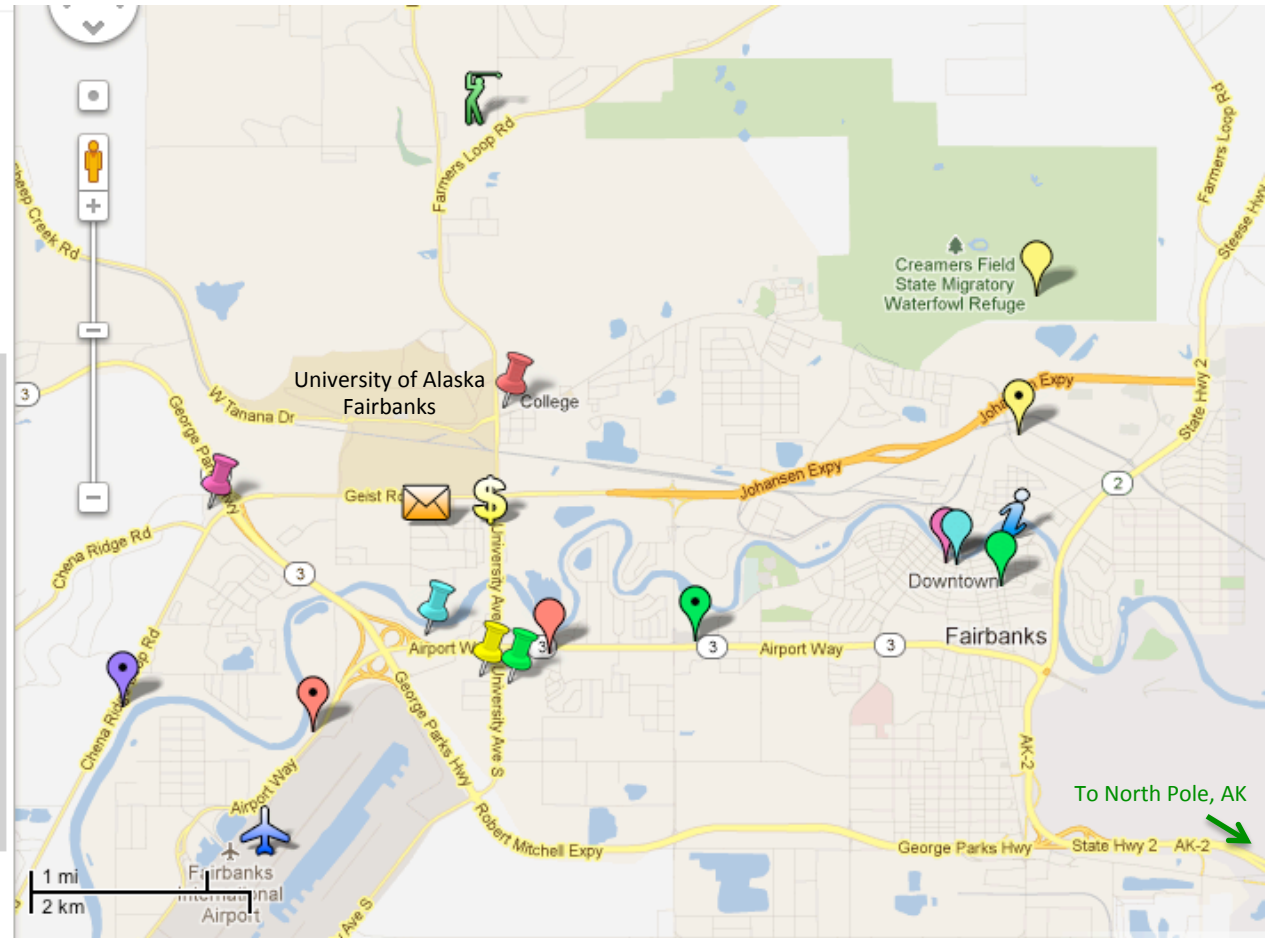
- Wood Center**
IGS Conference Events
- Sam's Sourdough Cafe**
Breakfasts, burgers, sandwiches, dinners
- Pad Thai Restaurant**
Thai food
- Fuji Japanese Restaurant**
- College Town Pizzeria**
- Sipping Streams Tea Company**
- Gulliver's Bookstore & 2nd Story Cafe**
- Hot Licks Homemade Ice Cream**
Ice Cream and shave ice
- Bun on the Run**
Bakery, sandwiches - closed Sunday
- Pita Place**
Falafel, Mediterranean cuisine, open Wed-Sat
- College Coffeehouse**
- Fina Azucar**
Cuban cuisine
- Alaska Coffee Roasting Company**
Coffee, tea, soup, sandwiches, pizza, bakery items
- McDonald's**
- Parking**
Free Parking in easternmost section, otherwise \$3/day - parking pa

Map data ©2012 Google - Edit in Google Map Maker Report a problem

Fairbanks Area Map

Selected Restaurants, Stores and Activities

-  Pioneer Park - Gifts, Palace Theater, Salmon Bake
-  Creamers Field - Birding, walking trails
-  Riverboat Discovery - IGS Banquet location
-  Fred Meyer - Groceries, toys, clothing and much more
-  Safeway - Grocery store
-  Wells Fargo Bank
-  Morris Thompson Cultural and Visitor Center
-  The Pump House Restaurant - along the Chena River
-  Pike's Restaurant - Dining along the Chena River
-  Beaver Sports - Camping & Sporting Goods Store
-  Thai House
-  Big Daddy's BBQ
-  Taco Azteca
-  Gambardella's Pasta Bella - Italian Restaurant
-  Gallo's Mexican Restaurant
-  Lemon Grass Thai Cuisine
-  US Post Office



PRACTICAL INFORMATION – CAMPUS UAF AND FAIRBANKS

Recreational Facilities

The Student Recreation Center (SRC) is available to all registrants and their guests at a rate of \$8 per day, payable at entrance. Facilities include a running track, free weights and weight machines, and basketball and tennis courts. You will need to carry in an extra pair of sneakers to use the SRC facilities (474-6814). There is an ice skating rink and swimming pool adjacent to the SRC. For information on ice rink hours call 474-6888.

UAF Bookstore And Post Office

The UAF Bookstore upstairs in Constitution Hall carries a wide selection of general reading books, UAF clothing and insignia, personal care items, and an assortment of food, drinks and over the counter medications. Hours are 0800–1700 Monday – Friday. The UAF Post Office is located in the lower level of Constitution Hall, hours are 1000–1600 weekdays.

Smoking Policy

No smoking is allowed inside buildings at the University of Alaska Fairbanks, including residence halls, dining halls, and the student center.

SAFETY and SECURITY

UAF is a safe and comfortable environment, but be prudent. Call the Campus Police at 474-7721 if you become aware of a situation that concerns you from a security or safety standpoint.

DO NOT LEAVE VALUABLES IN YOUR ROOM. NEITHER THE IGS ORGANIZERS, NOR THE UNIVERSITY OF ALASKA FAIRBANKS, ARE RESPONSIBLE FOR LOST OR STOLEN ITEMS.

Fairbanks Environment

Day length: There are about 20 hours of possible sunlight in mid-June (sun up at 0400 and down at midnight) and, if it is not cloudy, there will be daylight all night. You may find sleeping more comfortable if you have eyeshades.

Mosquitoes: Mosquitoes will probably be in good supply in late June, though not bad on campus. Elsewhere in Fairbanks, you may want to carry mosquito repellent with you. Wearing long sleeved shirts and long pants is recommended.

Aridity: Fairbanks, Alaska, is very dry. Make sure you drink plenty of water.

Temperature: Be prepared for a range of temperatures at this time of year. You can expect a range of about 45–75° F, (7-24 °C) but the record high was 91°F (33 °C) and record low was 30° F (-1 °C).

HEALTH and MEDICAL NEEDS

There are two walk-in medical facilities in Fairbanks:

Fairbanks Urgent Care Center	452-2178	weekdays	0700–2100
1867 Airport Way, Suite 130B		weekends	1000–1900
Tanana Valley Clinic 1 st Care	458-2682	daily	0800–2000
1001 Noble Street			

ATM Machines on Campus

Wood Center (available during Wood Center hours, 7:30 am – 7:00 pm Monday – Friday; 11:00 am – 6:00 pm Saturday)
Hess Commons, near the Housing Office in the upper campus dorm complex (available 24 hours)

Banking

Spirit of Alaska Federal Credit Union located in the Wood Center: Hours 1200–1600 weekdays. For full service banking needs, there is a Wells Fargo Bank on the corner of University Avenue and Geist Road.

Local Food Shopping

There are two grocery stores nearby, Fred Meyers and Safeway, located on the corner of University Avenue and Airport Way.

Wireless Network Access

You will have access to the UAFnet wireless network in the Wood Center, where the conference events will take place.

Local Restaurants

Local area dining – Fairbanks and the outlying area within walking distance of UAF

- Bun on the Run – Sandwiches and desserts (Trailer in the parking lot of Beaver Sports, 2480 College Road)
- College Coffee House – Espresso, light meals (3677 College Road) 374-0468
- College Town Pizzeria (3549 College Road) 457-2200
- Gulliver's Books & Second Story Café – Sandwiches, soups (3525 College Road) 474-9574
- Hot Licks – Homemade ice cream (3453 College Road) 479-7813
- Pad Thai – Thai (3400 College Road) 479-1251
- Azucar Fina - Cuban (3677 College Road) 456-2822
- Fuji Japanese Restaurant – (3535 College Road) 328-3228

Marginal walking distance from UAF

- Alaska Coffee Roasting Company – Espresso, light meals (4001 Geist Road)
- McDonald's (3905 Geist Road) 474-2010
- Sam's Sourdough Café – Family style (3702 Cameron, off University Avenue) 479-0523
- Wolf Run – Light meals and desserts (3360 Wolf Run, off University Avenue) 458-0636

Need a car – fast food

- Kentucky Fried Chicken (3428 Airport Way) 452-1010 or (62 College Road) 452-7546
- McDonald's (1930 Airport Way) 452-4600
- Pizza Hut (1991 Airport Way) 456-5656
- Quiznos (3598 Airport Way) 458-7849
- Subway (3574 Airport Way) 479-8688
- Taco Bell (87 College Road) 452-3166 or (1453 University Avenue) 474-9526
- Wendy's (1859 Airport Way) 456-3663

Need a car – casual dining

- The Bakery Restaurant – Family style (69 College Road) 456-8600
- Boston's Pizza – Family style (Old Steese Highway)
- Brewsters – Burgers, salads (3578 Airport Way) 456-2538
- Brueggers – Bagels, soups, salads, sandwiches (36 College Road) 452-3940
- The Chowder House – Chowder, soup, sandwiches (206 Eagle Avenue) 452-2882
- Cookie Jar – Family style (1006 Cadillac Court) 479-8319
- Denny's – Family style (1929 Airport Way) 451-8950
- Food Factory – Burgers, hot wings, cheese steak (44 College Road) 452-3313
- Ivory Jack's – 2nd best burger in Alaska, pizza (2581 Goldstream Road) 455-6665
- Alaska Salmon Bake – Salmon, halibut, prime rib (Pioneer Park) 452-7274
- El Sombrero – Mexican (1420 Cushman Street) 456-5269
- Geraldo's – Italian (3226 Airport Way) 474-0409 (701 College Road) 452-2299
- Lulu's Bagels – Bagels, soups, salads, sandwiches (364 Chena Pump Rd) 374-3804
- Lemon Grass – Thai (388 Old Chena Pump Road) 456-2200
- Thai House Restaurant – Thai (526 5th Avenue) 452-6123
- Sweet Basil Thai Restaurant – Thai (1448 South Cushman Street) 456-2170
- Taco Azteca – Mexican (3401 Airport Way) 455-8226

Need a car – fine dining

- Bear 'n' Seal Grill & Bar (813 Noble Street, in the Westmark Hotel) 459-7725
- Gambardella's Pasta Bella – Italian (706 2nd Avenue) 456-3417
- Lavelle's Bistro (575 1st Avenue, in the Spring Hill Suites Marriott Hotel) 451-0765
- Pike's Landing Fine Dining & Sports Lounge – Fish, steak, seafood (4438 Airport Way) 479-6500
- Pump House Restaurant & Saloon – Fish, steak, seafood (Mile 1.3 Chena Pump Road) 479-8452
- River's Edge Restaurant & Cocktails (4200 Boat Street) 474-3601
- Turtle Club -Prime rib and crab (Mile 10 Old Steese Highway) 457-3883
- Two Rivers Lodge Fine Dining – Everything from alligator to steak (Mile 16 Chena Hot Springs Road) 488-6815
- The Vallata – Italian (2190 Goldstream Road) 455-6600
- Zach's – Steak, seafood, pasta (1717 University Avenue) 479-3650

Things to do in Fairbanks and the surrounding area

Activities on campus

- Check out the campus calendar <http://www.uaf.edu/calendars/events/>
- Cold Climate Housing Research Center – Call 457-3454 for tour times.
- Georgeson Botanical Garden – Numerous varieties of flowers and vegetables cultivated for Alaska's climate. Open for viewing daily. 474-1944
- Robert G. White Large Animal Research Station – View muskox, caribou, and reindeer. Tours daily. 474-7207
- University of Alaska Museum of the North – Discover fascinating stories about Alaska's people, places, and wildlife. Audio guide available. Museum store. 0900–1900. 474-7581

Activities around town

- Alaskan Tails of the Trail with Mary Shields – Learn about Mary's adventures in mushing the Iditarod and through the Alaska wilderness. 455-6469
- Chena Bend Golf Course – Beautiful golf course located on Fort Wainwright. 353-6223
- Chena Hot Springs Resort – Soak in the hot springs and visit the ice museum. 451-8104
- Creamer's Field Migratory Waterfowl Refuge. 452-5162
- El Dorado Goldmine/Gold Dredge No. 8 – Ride the Tanana Valley Railroad and pan for gold. 479-6673
- Fairbanks Convention and Visitors Bureau, 101 Dunkel Street, Suite 111, 456-5774
- Fairbanks Golf and Country Club – Play a game of golf under the midnight sun. 479-6555
- Greatland River Tours (Tanana Chief) dinner & Sunday brunch cruises. 452-8687
- Ice Museum – Ice sculptures on display. Downtown on 2nd Avenue. 451-8222
- North Star Golf Club – Northern-most USGA golf course. 457-4653
- Pioneer Park – Visit this historic park for Fairbanks history, train rides, miniature golf, picnic grounds, and many gift shops housed in historic log cabins. 459-1087
- Palace Theatre and Saloon – Musical comedy about early Fairbanks. 452-7274
- Riverboat Discovery – Enjoy a boat cruise on the Chena and Tanana Rivers, including a guided walking tour of an Indian Village. 479-6673
- Tanana Valley Farmers Market – View items produced by Fairbanks area farmers and artisans. College Road, Wednesdays & Saturdays.
- Trans-Alaska Pipeline – Information and viewing, on the Steese Highway.

Art galleries and shops

- Fairbanks Arts Association – Bear Gallery in the Pioneer Park Civic Center. 456-6485
- Alaska House – 1003 Cushman Street. 456-6449
- Well Street Art Company – 1304 Well Street. 452-6169
- Knotty Shop – Wood crafts, burl carving and 30-foot totem pole. 488-3014
- Santa Claus House – North Pole. 488-2200

Be adventurous

- Rent a canoe and paddle the Chena River – canoe/kayak rentals available at Pioneer Park dock, 457-2453.
- Hike one of the many trails located throughout the Tanana Valley, such as Angel Rocks or Granite Tors.
- Visit Denali National Park, travel by rail or car; activities include: white-water rafting, flight-seeing, hiking, bus tours.
- Relax at one of the numerous lakes for a camping and fishing trip.
- Alaska Public Lands Information Center – 101 Dunkel Street, Suite 110, 8 am – 6p m daily, 459-3730.

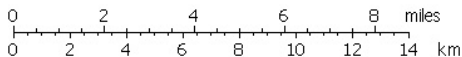
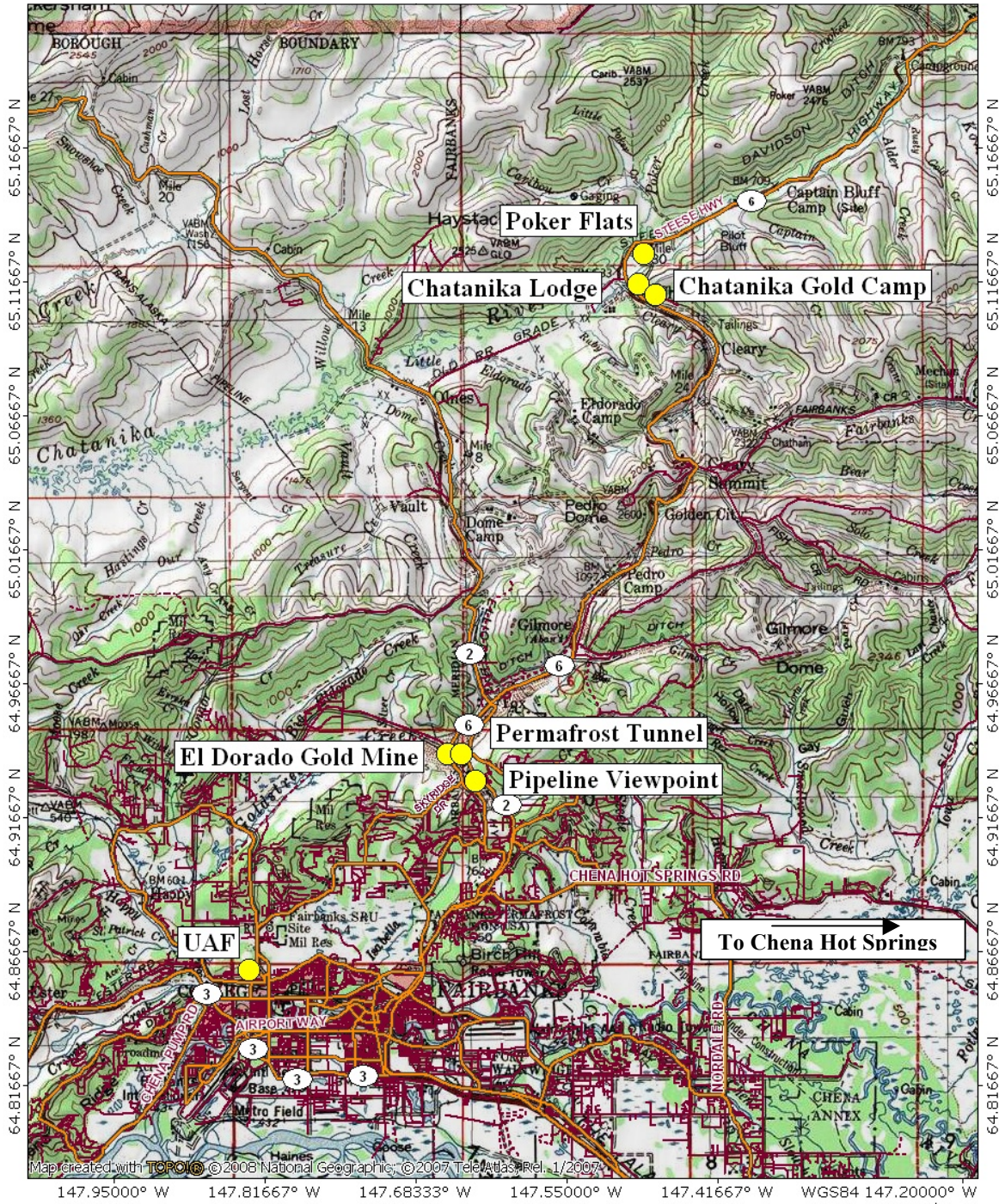
Shopping near campus

- Beaver Sports – Sporting goods, clothing (3480 College Road) 479-2494
- Date Line Copies – Copying, office supplies (3677 College Road) 479-3831
- Fred Meyer – Groceries, housewares, clothing (3755 Airport Way) 474-1400
- Gulliver's Books – Books, gifts (3525 College Road) 474-9574
- INUA Wool Shoppe – Yarns and knitting supplies (3677 College Road) 479-5830
- Safeway – Groceries (3627 Airport Way) 374-4000

International Glaciology Symposium

Mid-Excursion

27 June 2012



TRANS-ALASKA PIPELINE SYSTEM

The **800-mile** Trans-Alaska Pipeline System (TAPS) was built between 1974 and 1977 after the 1973 oil crisis. It is operated by Alyeska Pipeline Service Co. (Alyeska) on behalf of the pipeline owners. The pipeline originates at the Prudhoe Bay oil fields on the North Slope of Alaska and ends at the ice-free port of Valdez. The pipeline route is underlain with **continuous permafrost** in the north, where the climate is the coldest. South of the Brooks Range, across interior Alaska, the permafrost is discontinuous, transitioning to sporadic permafrost along the southern portion of the Copper River basin. Climate records indicate a gradual warming trend along the entire pipeline route. Permafrost temperature monitoring shows similar trends but with slower warming. Alyeska has focused much of its attention on discontinuous and sporadic permafrost, which are close to the melting temperature of ice. Climate and ground-temperature monitoring is ongoing to track and appropriately respond to temperature changes.



Monitoring the Effects of Climate Change

Alyeska monitors climate change in several ways. Alyeska constructed and operates 43 instrumented thermal-monitoring sites along the pipeline corridor from the Brooks Range to Thompson Pass. At these sites, air, surface, subsurface ground, and permafrost temperatures are recorded. In addition, there are over 80 thermistor strings installed in the ground along the pipeline route that measure soil temperatures.

TAPS Pipeline Support System

Vertical support members (VSMs) are pipe pilings embedded in the ground to support the above-ground pipe in areas of thaw-unstable permafrost. Most VSMs south of the Brooks Range have heat pipes installed to keep the ground frozen around the embedded portion of the VSMs. These heat pipes are sealed thermosiphons that begin to remove heat from the ground when air temperatures fall below ground temperatures. Over the length of the pipeline, 78,000 VSMs are embedded 15 to 70 feet in the ground. In total, 61,000 thermal VSMs are configured with 122,000 individual heat pipes, two per VSM.

Alyeska heat-pipe monitoring and other thermal studies indicate that the ground around the VSM piling is being maintained in a frozen state. The vast majority of VSMs are not moving, which means climate changes are not presently affecting VSM stability. VSM settling or movement can be caused by a variety of reasons. When settling or movement is discovered, engineering studies determine the appropriate action necessary to re-establish stability.

Heat-Pipe Infrared Evaluations

Infrared surveys of all the heat pipes on the Trans-Alaska Pipeline occur on a three-year cycle. These data are used to predict the performance of the heat pipes installed at every thermal VSM. Heat pipes not meeting the required performance criteria are then listed for repair. The repair procedure requires recharging the listed heat pipe with refrigerant and designating subsequent infrared surveys to ensure the heat pipes are working properly after maintenance.

After the heat pipe has been recharged, the temperature of permafrost at the base of the VSM is determined through pressure measurements that are converted to temperatures. If the permafrost temperature is approaching 32°F (0°C), additional temperature monitoring is conducted. Other spot checks measure permafrost temperatures where heat pipes have been recharged and where heat pipe recharging is not required to verify that methods used to maintain frozen conditions are working.

PERMAFROST TUNNEL

The Cold Region Research and Engineering Laboratory's permafrost tunnel, located 16 km north of Fairbanks, provides a unique opportunity to explore the 40,000-year-old permafrost from underneath. The tunnel was constructed in the early 1960s by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) to test mining, tunneling, and construction techniques in permafrost. This facility is one of the few underground exposures of syngenetic Pleistocene-age permafrost. Located among the former mining claims along Goldstream Creek, the location was chosen for its man-made escarpment and its continual permafrost (in the Fairbanks area, permafrost is common but occurs in patches). The tunnel was first used to test underground excavators in the winters of 1963-66. Now it is also an invaluable "natural laboratory" for natural scientists and engineers alike. The main tunnel is about 110 m long and 15 m below the surface; a second inclined tunnel was added in 1968-9, travelling down to about 20 m below surface. In addition to the ice structures, the tunnel excavations have unearthed a fascinating array of animal and plant fossils, all, quite literally, frozen in time.

By definition, the permafrost is syngenetic because it is of the same age (approximately) as the host sediment. Thus, transformation of active-layer sediments into a perennially frozen state occurs virtually simultaneously with sedimentation. Natural exposures of ice-rich permafrost quickly degrade and provide only opportunistic study. The permafrost tunnel allows hundreds of visitors the unhurried opportunity to become acquainted with ice-rich permafrost and for professionals to study the peculiarities of syngenetic permafrost and its history.

The tunnel entrance is on the eastern margin of Goldstream Creek valley, where a steep 10-m-high escarpment was created by placer-gold mining activities in the first part of the previous century. The surface of the valley that lies immediately above the long axis of the tunnel rises gently from the top of the escarpment in which the entrance is located toward the east side of Goldstream Creek valley. The active layer of the terrain that overlies the tunnel is between 0.7 and 1 m thick, which is typical of the Fairbanks area.

Syngenetic Permafrost

Pleistocene syngenetic permafrost exists mainly in the continuous permafrost zone of Siberia, and its presence in the discontinuous permafrost zone of Alaska is a rare phenomenon. This type of permafrost is also found in the valleys and lowlands of adjacent unglaciated Yukon Territory, Canada.

Syngenetic permafrost is often characterized by numerous ice veins and ice wedges. In contrast to epigenetic permafrost, in which ice wedges rarely exceed 4 m in depth, ice wedges in syngenetic permafrost may extend through the entire strata, either as huge wedges reaching 10-40 m in depth and 2-6 m in width or as small ice veins throughout the profile. Their varying width and depth reflect the varying rates of sedimentation and climate conditions. In syngenetic permafrost bodies, wedge ice can occupy 30-50 percent, and even more in some cases, of the total volume. In color, the ice wedges are gray because of the numerous inclusions of fine sediment, and they can easily be distinguished from smaller Holocene and modern ice wedges located in the top part of Yedoma sections, because the latter are usually white and opaque due to fewer soil inclusions and an abundance of air bubbles.

Massive Ice Bodies

Bodies of massive ice are exposed in the walls and ceiling of the CRREL tunnel and impress the first-time visitor. These bodies are the most visible expression of the ice-rich nature of Pleistocene syngenetic permafrost. Three types of massive ice can be identified: wedge ice, clear ice, and clear ice with wedge-ice inclusions.

CHATANIKA AREA GOLD MINING HISTORY

In 1902 a miner named Felice Pedroni (later known as Felix Pedro) located good gold prospects in the Tanana River valley. News of Pedro's gold discovery spread. By September 1902, dozens of prospectors had arrived in the area. A settlement grew around a trading post opened by Elbridge Truman "E.T." Barnette. At the urging of Judge Wickersham, Barnette suggested to the new residents that they name the new community Fairbanks, honoring Indiana Senator Charles Fairbanks, who was chairman of the Joint High Commission charged with settling the Alaska-Canada boundary dispute. Within a year, Fairbanks had attracted 1,200 people.

Near the new community was a better location for sternwheelers to dock. A second town, Chena, developed at this site. Fairbanks promoters, however, successfully waged war with this new competing town. The deciding factor was Judge Wickersham's transfer of the seat of the third judicial district from Eagle to Fairbanks.

Driving north from Fairbanks on the Steese Highway, it is possible to see two **pipelines**. One is bright and shiny and carries oil; the other is old and rusted and carried water years ago. Both are remarkable examples of engineering

for their day. The rusty pipe, almost exactly the same diameter (46–56 inches) as the Trans-Alaska Pipeline (48 inches), represents the remnants of a project undertaken from 1924 to 1929 to bring water to Fairbanks area gold-mining operations. The construction was carried out under the auspices of the Fairbanks Exploration Company (known locally as F.E. Co.), a subsidiary of United States Smelting, Refining and Mining Company (U.S.S.R. & M.). This project, known as the Davidson Ditch, was a 90-mile-long conduit designed to divert water from the Chatanika River at a point below the junction of Faith and McManus creeks to hydraulic sluicing (stripping) operations at Cleary and Goldstream, just north of Fairbanks. The term “ditch” does not do the project justice because, although the open earthwork section comprised most of its length, the course included a 0.7-mile-long tunnel near Fox, and 6.13 miles of inverted siphons along the way. The inverted siphons, which are the pipes visible today, were masterpieces of engineering at the time. There were 15 siphons in all, crossing ridges and the creek beyond. The longest siphon was a 7,961-foot section that crossed the Chatanika River with a head of 544 feet. (The reason that Chatanika water crossed above its source river downstream from the inlet is that the Davidson Ditch had a gradient of only 2.112 feet per mile, whereas the river’s gradient is significantly higher.) (Boswell, 1979)

Gold dredge No. 8 / El Dorado Gold Mine

Described as either a floating workhorse or a mechanical gold pan, Gold Dredge No. 8 extracted millions of ounces of gold from the frozen Alaskan ground. Today, the Gold Dredge No. 8 National Historic District serves as a monument to the hard working miners who built Fairbanks. A two-hour guided tour takes you through a permafrost tunnel where Alaska's history comes alive. **The main attraction at the El Dorado Gold Mine is the opportunity to pan for your own gold right out of a sluice box. Everyone finds gold !**

Chatanika gold dredge

The Chatanika gold dredge is a historic relic of gold dredge #3 owned and operated by F.E. Company between 1928 and 1958. The dredge is located in a 60 acres (24 ha) pond it dug itself, directly across the road from the Chatanika Lodge (see photo).



POKER FLAT RESEARCH RANGE

Poker Flat Research Range (PFRR) is the only non-federal, university owned and operated **rocket range** in the world and the only high-latitude, auroral-zone rocket-launching facility in the United States. Owned and operated by the University of Alaska Geophysical Institute since 1968, the range primarily has been dedicated to the launch of sounding rockets for auroral and middle- to upper-atmospheric research. Range operations are funded through contracts with NASA, and the range has been operating under a cooperative agreement between NASA and the Geophysical Institute since 1979. The name “Poker Flat” is likely derived from the proximity of the facility to Poker Creek, or perhaps from Francis Bret Harte’s 1869 short story, “The Outcasts of Poker Flat.” Today the range has five major launch pads, three S-Band antennas, and a C-band radar. Research areas include the aurora borealis, ultraviolet radiation, the ozone layer, and the planet’s magnetic field.

A small group of university employees work year-round at the facility to maintain the physical plant, provide launch support, and obtain the various waivers, approvals, and agreements necessary for operation. Past funding sources include the Defense Nuclear Agency, the U.S. Air Force Geophysics Laboratory, the National Science Foundation, and the National Oceanic and Atmospheric Administration (NOAA).

The 5,132-acre site, located about 30 miles northeast of Fairbanks, Alaska, is the world’s largest land-based rocket range and has an established chain of downrange flight and observation facilities from inland Alaska to Spitsbergen, Norway, in the Arctic Ocean, for monitoring and recovery purposes. Data from various scientific instruments are collected by Poker Flat Geospace Environment Data Display System (GEDDS) (<http://www.pfrr.alaska.edu/tour/pfrr/gedds.htm>) and at the Geophysical Institute’s Data Analysis Center (<http://www.pfrr.alaska.edu/tour/uaf/dac.htm>).

CHENA HOT SPRINGS

Located 60 miles east of Fairbanks, and sitting in the middle of a 40 square-mile geothermal area, Chena Hot Springs Resort has been in existence for over a century. Founded in 1905 by an early Fairbanks settler searching for relief for his rheumatism, the resort originally included twelve small cabins, a stable, and a boathouse. Ever since, the resort has been the premier place for Fairbanks residents to take in the delightful natural scenery and enjoy the healing powers of the hot spring waters. Today, the resort offers visitors three main attractions: bathing in the hot springs, touring the carved ice sculptures of the Ice Museum, and hiking the extensive trail system. For visitors in the cold winter months, the resort is also an excellent viewing spot for the aurora borealis. Water flows out of the hot springs at 156F (69C), so the water is first cooled for bathers to a more tolerable 100-110F (38-43C). In 2004, the Ice Museum at Chena Hot Springs Resort was featured in a Forbes Magazine article titled “The Dumbest Business Idea of The Year,” based on the fact that the entire building melted during the summer. But Bernie Karl, the owner of the Chena Hot Springs since 1998, did not give up, and he designed a cooling system operating on geothermal power to keep the structure intact year round. By 2010, Karl’s former critics had been all but silenced; his plan succeeded, and he was even the recipient of an award from the Geothermal Resource Council for his innovative system. Other notable attractions at the resort are the geothermal power plant, the resort’s mushing kennel of over 50 Alaskan husky sled dogs, and the greenhouses, which provide fresh produce even in the winter.

REFERENCES

Stevens, D.S.P. (ed.), (In Press), Division of Geological and Geophysical Surveys Guidebook 11. Guide to Permafrost and Quaternary Geology of the Fairbanks Area, Alaska. Prepared for Ninth International Conference on Permafrost June 29 – July 3, 2008, University of Alaska Fairbanks, 109 p.

Boswell, J.C., (1979), History of Alaskan Operations of United States Smelting, Refining, and Mining Company: Fairbanks, University of Alaska, Mineral Industry Research Laboratory Special Publication, 126 p.