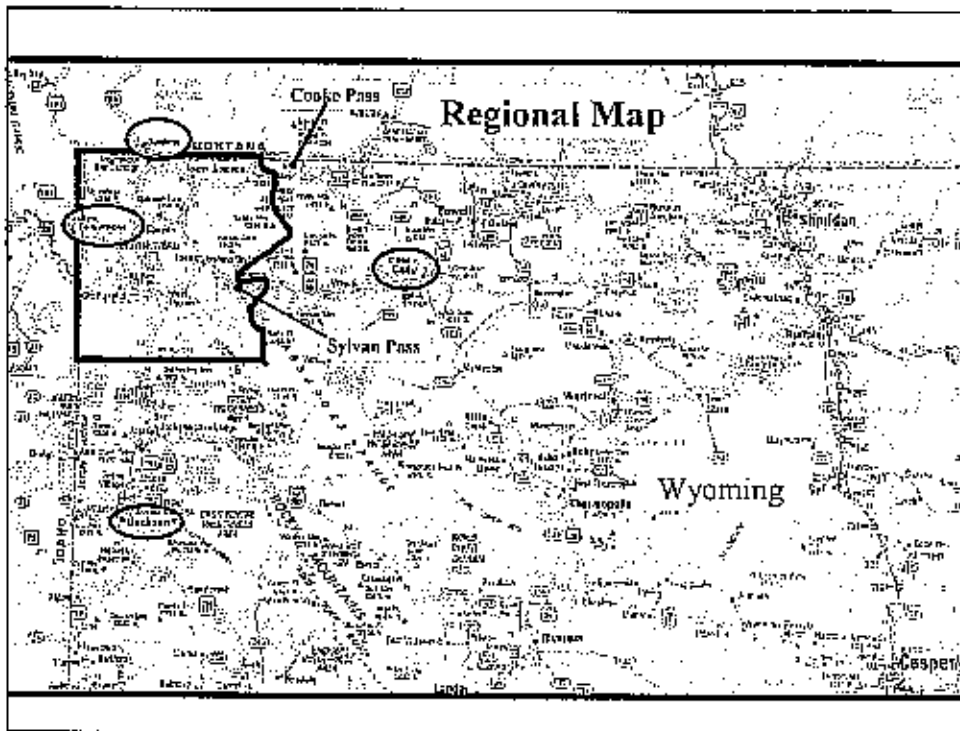
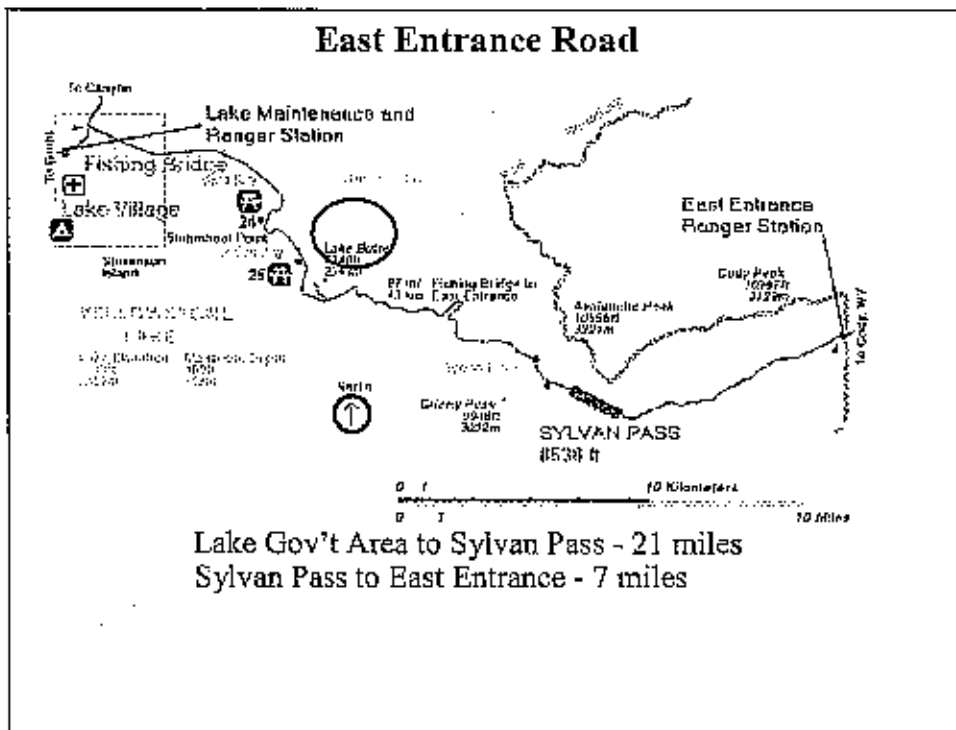
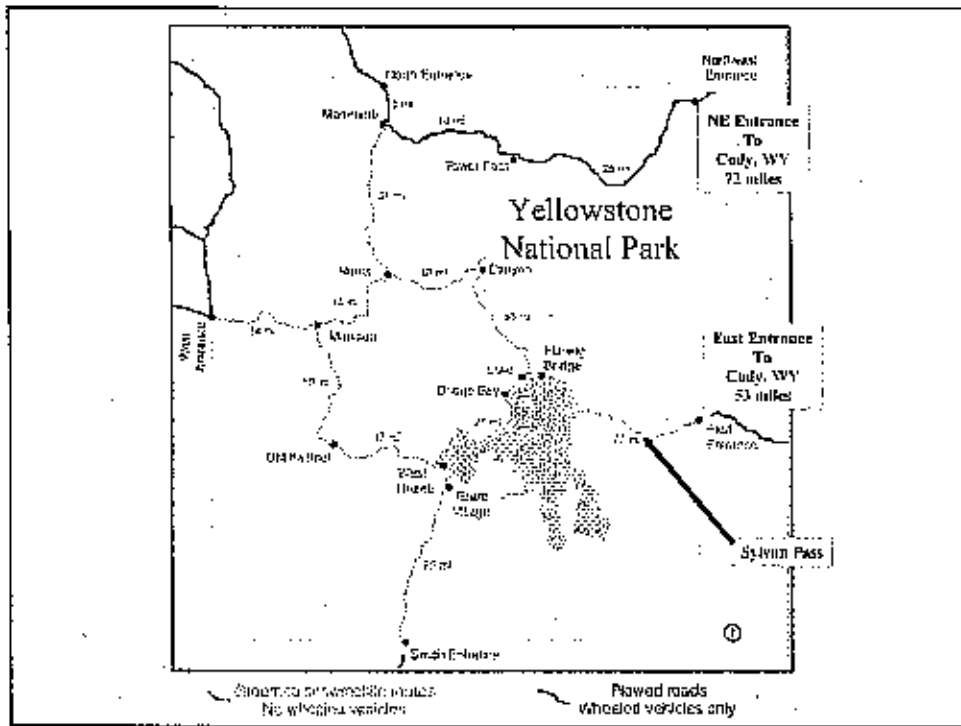


Sylvan Pass Avalanche Control and Grooming Operations

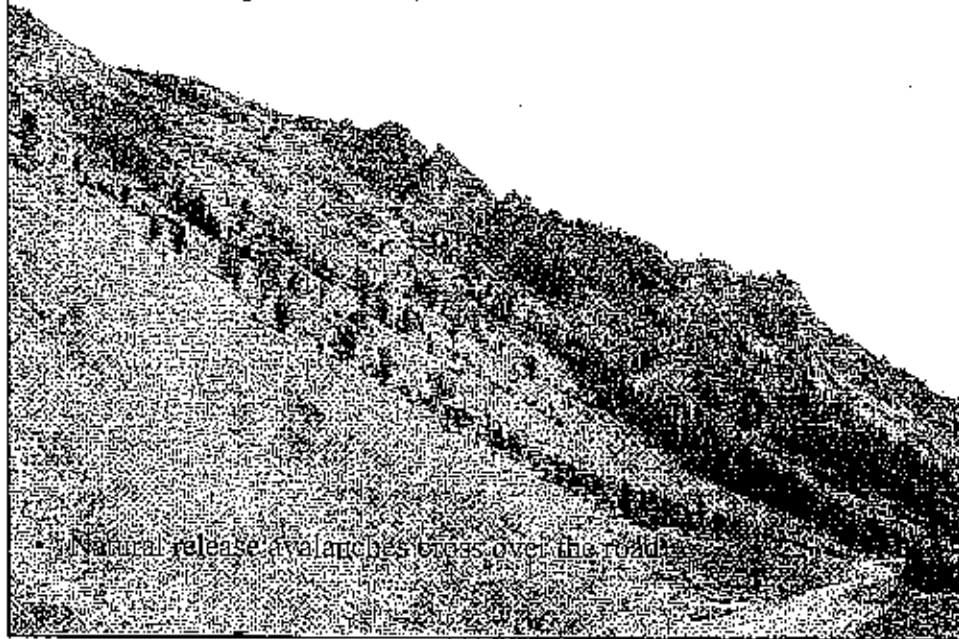
Compiled by: Brad Ross, Bruce Sefton, Michael P. Kraliv - LIAE Sub-Division, Yellowstone National Park

REVISED MAY 12, 2004

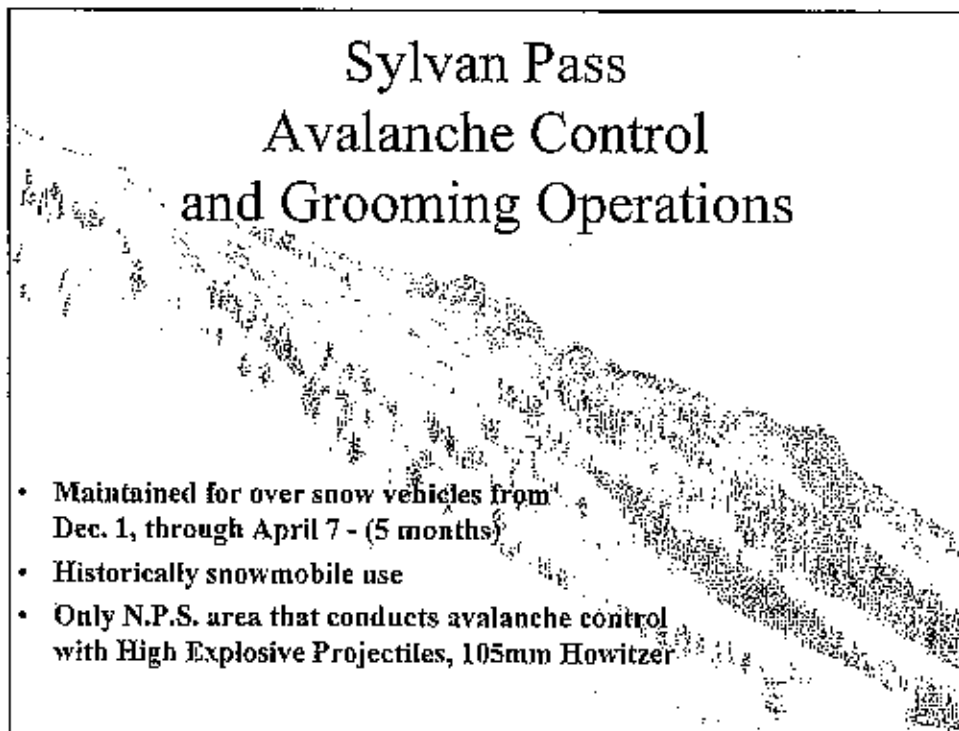




Sylvan Pass, East Entrance Road



Sylvan Pass Avalanche Control and Grooming Operations

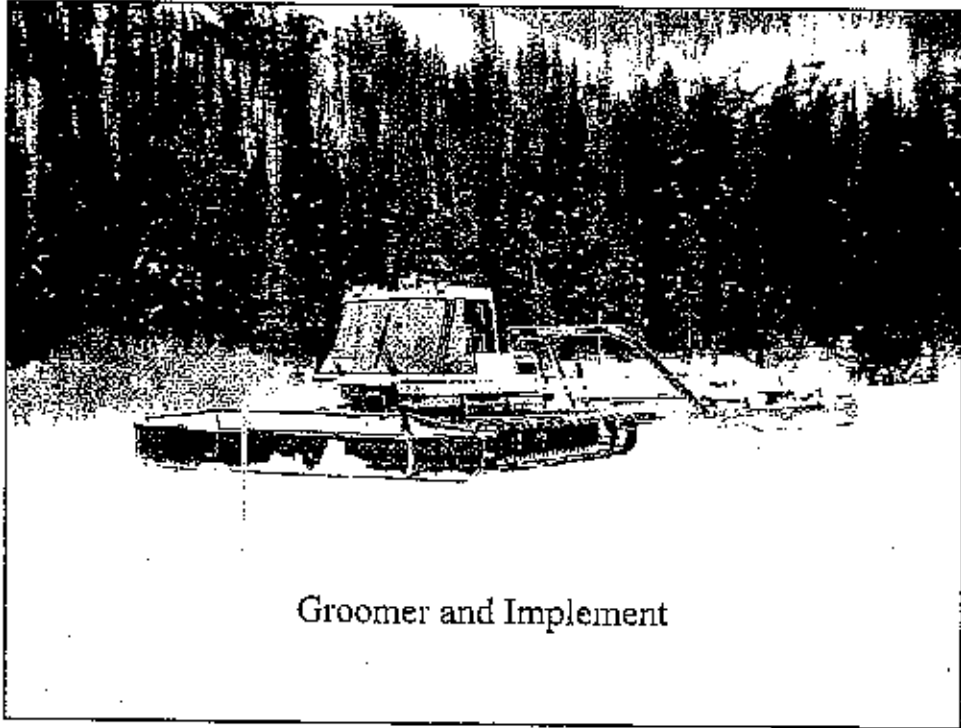


Topics of Discussion

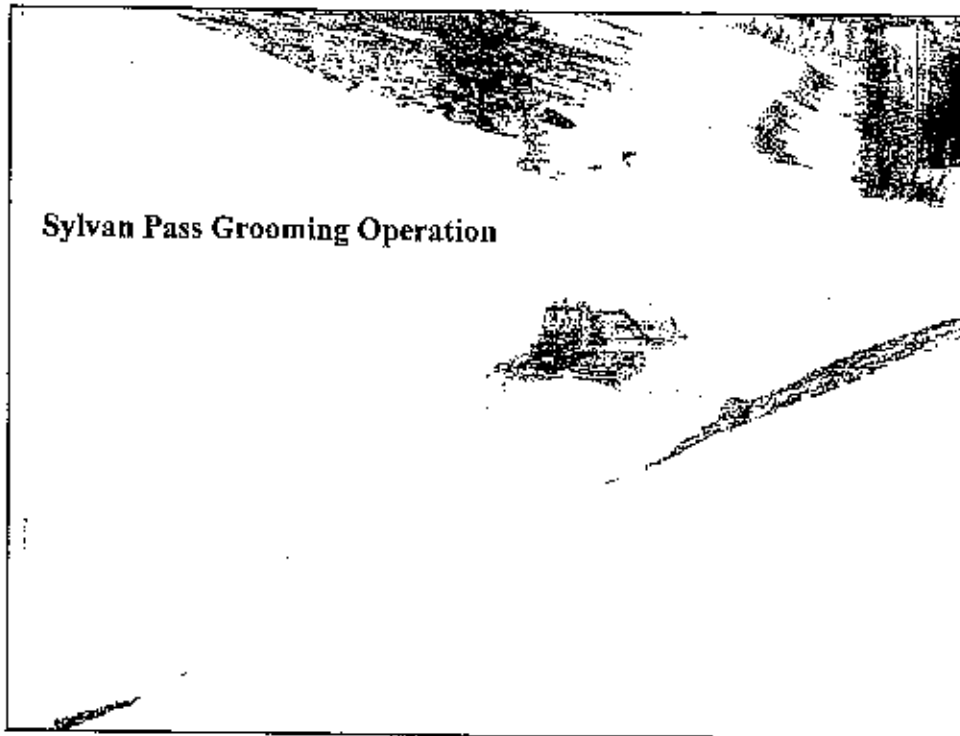
- * Road Maintenance/Grooming
- * Avalanche Forecasting
- * Howitzer Program
- * Operational Alternatives

Grooming for increased Snowcoach use





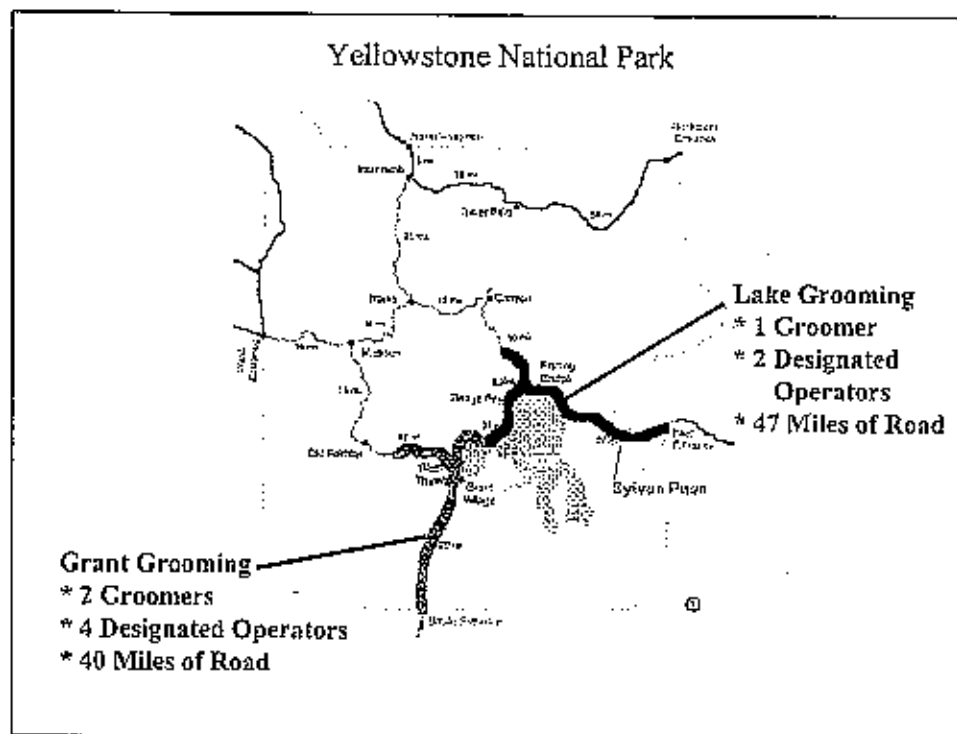
Groomer and Implement

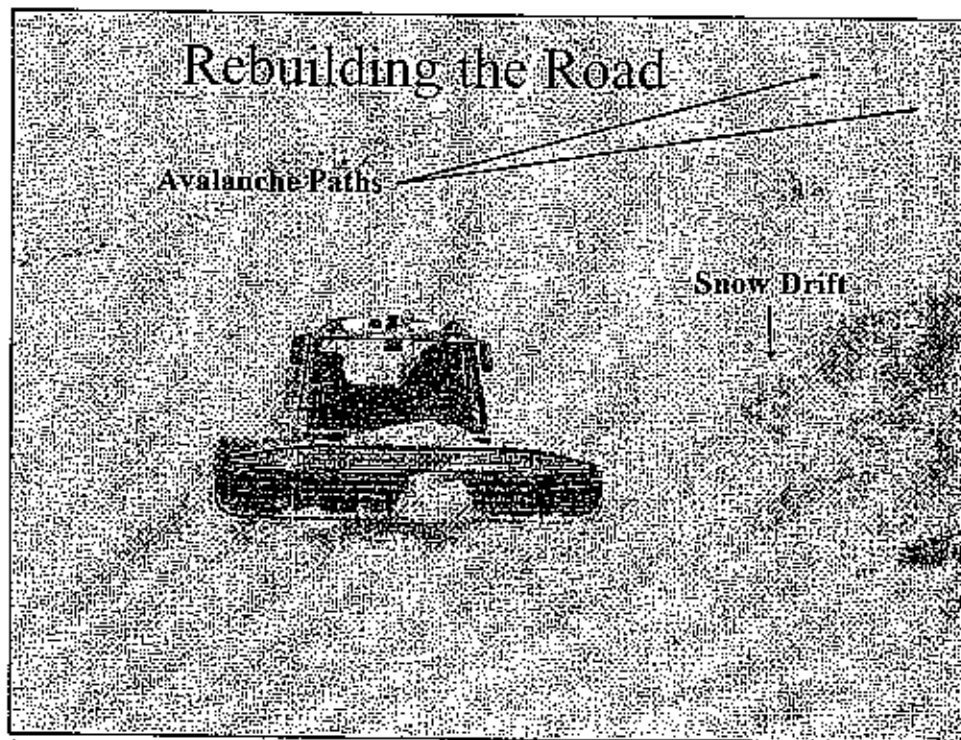
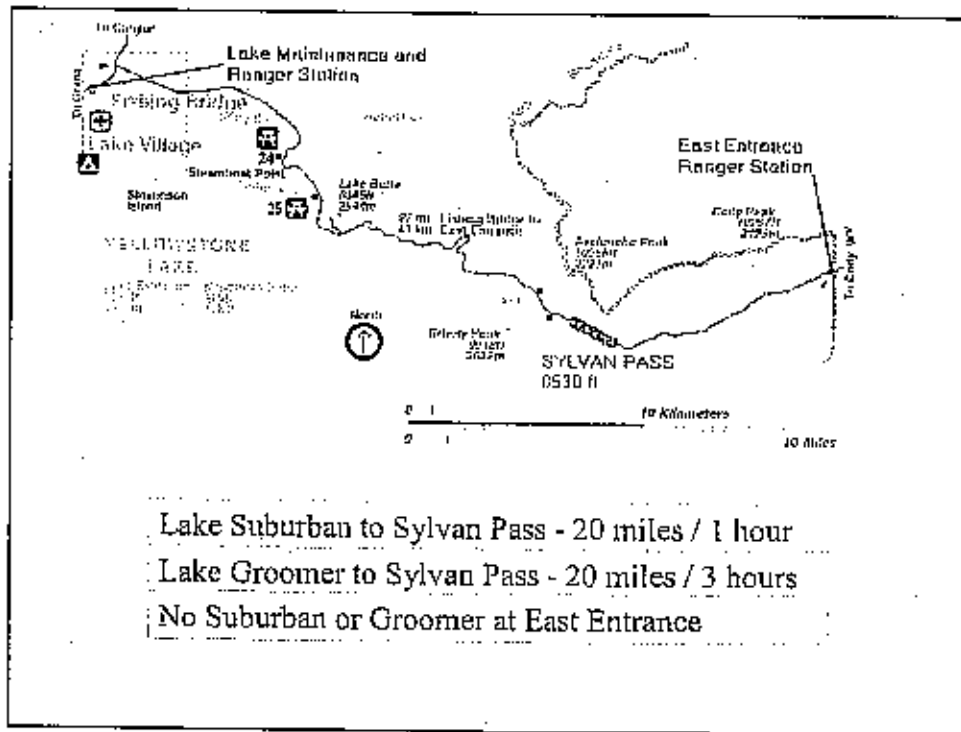


Sylvan Pass Grooming Operation

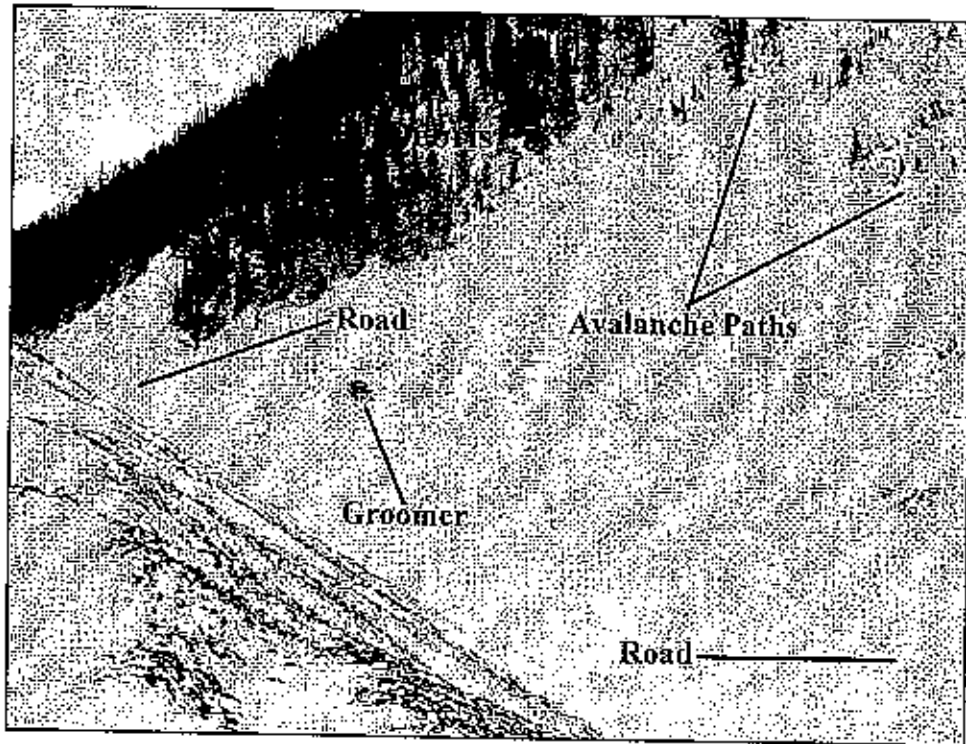
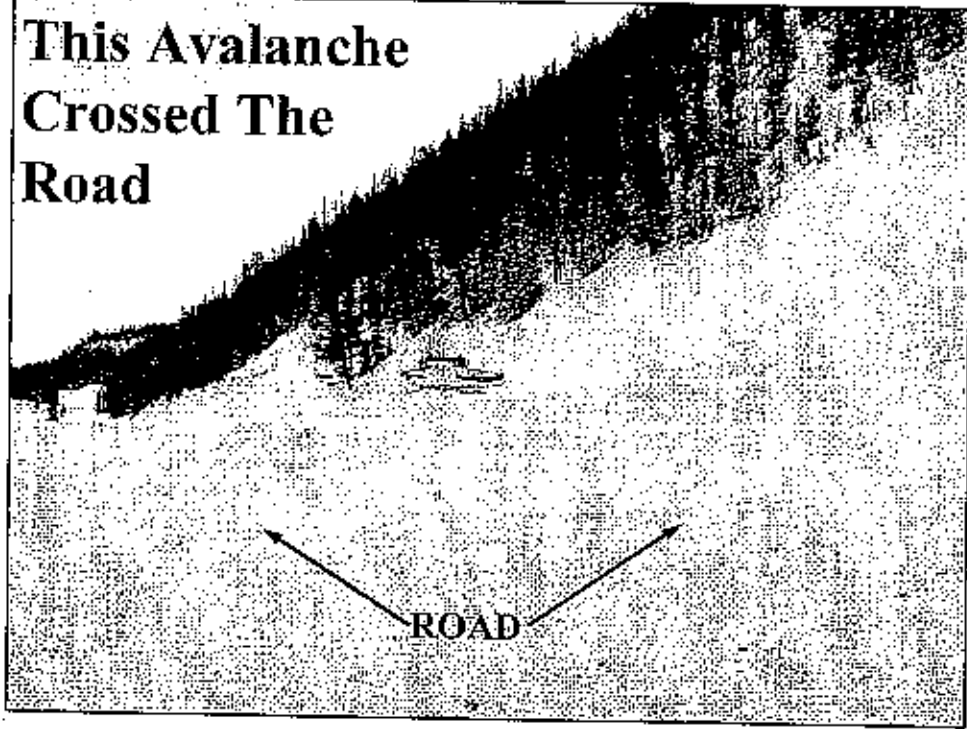
Road Grooming

- Purchase of groomer and implement is expensive
- Initial and ongoing training of operators is required
- Ongoing maintenance and repair is required
- Grooming is required to:
 - Establish a road through avalanches debris
 - Remove snow drifts that cause unsafe travel conditions
 - Provide a hard/smooth road surface
 - Meet established standards in Yellowstone

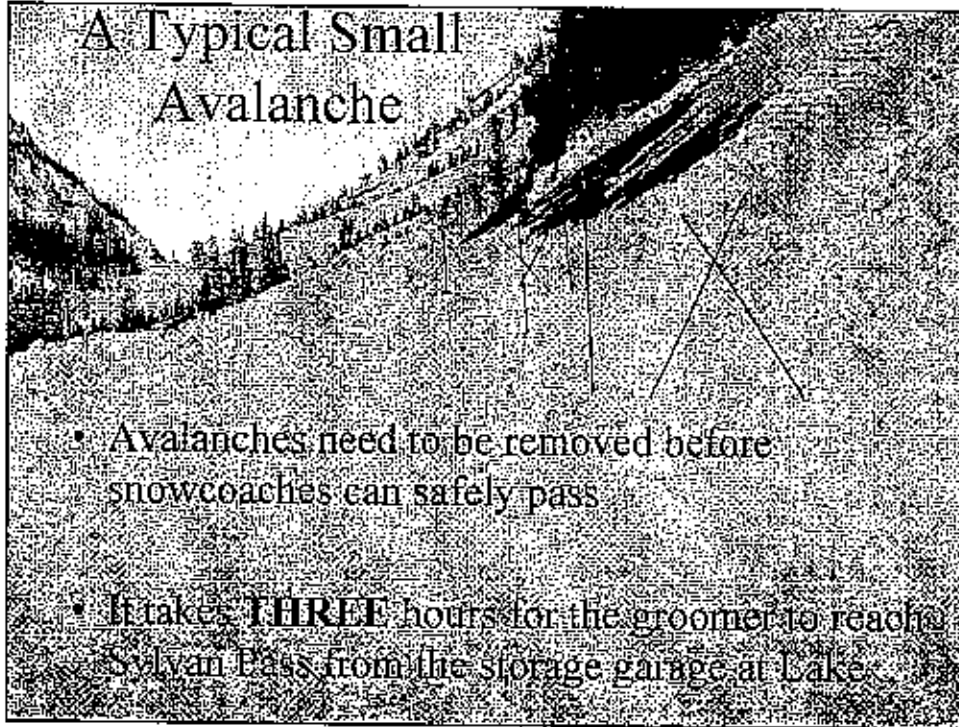




**This Avalanche
Crossed The
Road**



A Typical Small Avalanche



- Avalanches need to be removed before snowcoaches can safely pass
- It takes **THREE** hours for the groomer to reach Sylvan Pass from the storage garage at Lake

Avalanche Forecasting Program

- Training
 - National Avalanche School
 - Continuing education
- Hazard Forecasting
 - Observations
 - Snow Study Pits
 - Sno-tel Data
 - Regional Forecasters

Snow Study Pit



Avalanche Forecasting Data

Sno-tel Data

Location: 472000-100000000
 Date: 2/10/2000
 Time: 07:30

Sno-tel Data

Site: 472000-100000000
 Elevation: 2000
 Aspect: N
 Exposure: E

Wind: S
 Gust: 15
 Temp: 20
 Humidity: 80
 Visibility: 10
 Clouds: 50
 Precip: 0
 Snow Depth: 10
 Snow Wetness: 0
 Snow Type: 1
 Snow Grain: 0
 Snow Color: 0
 Snow Texture: 0
 Snow Density: 0
 Snow Adhesion: 0

Remarks: Clear, no wind, no precipitation, snow depth 10 cm, snow wetness 0, snow type 1, snow grain 0, snow color 0, snow texture 0, snow density 0, snow adhesion 0.

Snow Study Pits

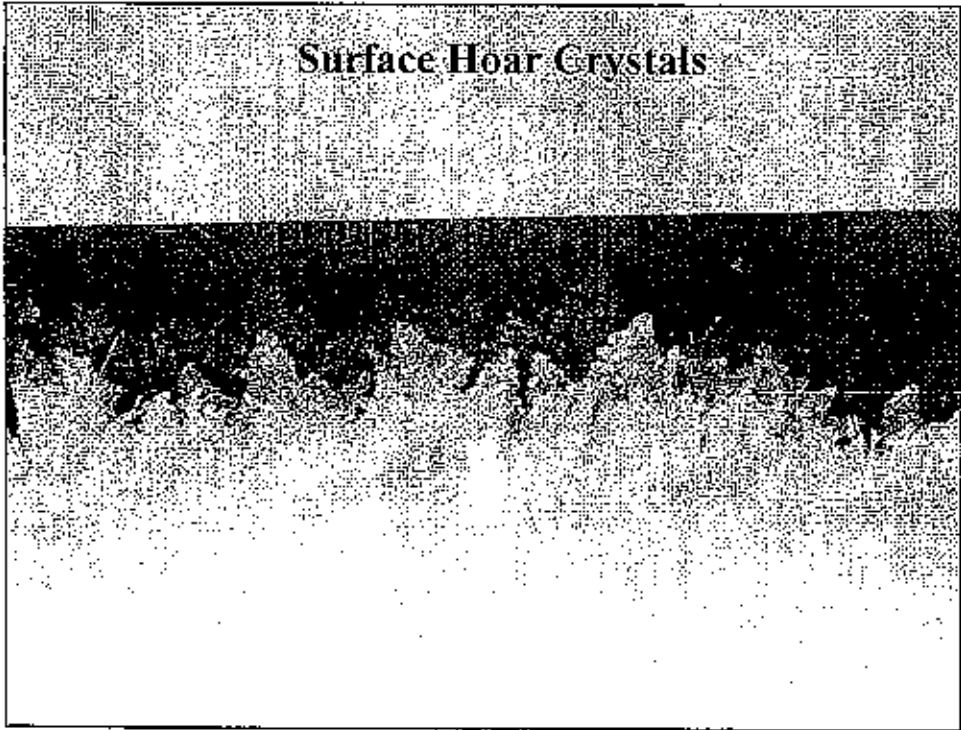
Location: 472000-100000000
 Date: 2/10/2000
 Time: 07:30

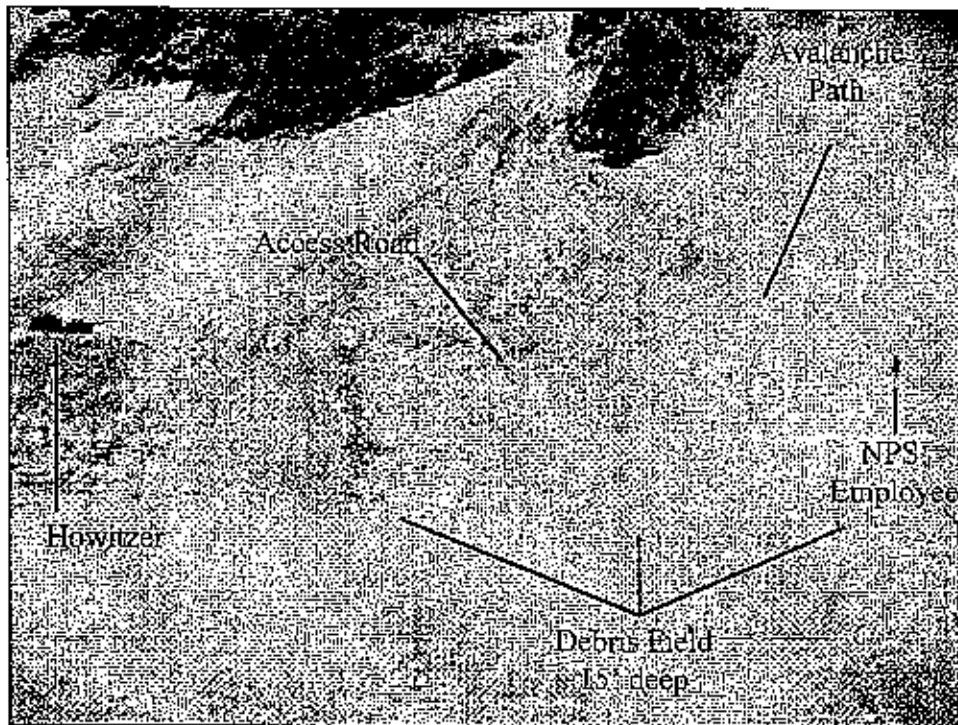
Snow Study Pits

Site: 472000-100000000
 Elevation: 2000
 Aspect: N
 Exposure: E

Depth (m)	Temp (°C)	Humidity (%)	Wind (m/s)	Clouds (%)	Precip (mm)	Notes
0.0	20	80	15	50	0	Surface
0.5	20	80	15	50	0	
1.0	20	80	15	50	0	
1.5	20	80	15	50	0	
2.0	20	80	15	50	0	
2.5	20	80	15	50	0	
3.0	20	80	15	50	0	
3.5	20	80	15	50	0	
4.0	20	80	15	50	0	
4.5	20	80	15	50	0	
5.0	20	80	15	50	0	
5.5	20	80	15	50	0	
6.0	20	80	15	50	0	
6.5	20	80	15	50	0	
7.0	20	80	15	50	0	
7.5	20	80	15	50	0	
8.0	20	80	15	50	0	
8.5	20	80	15	50	0	
9.0	20	80	15	50	0	
9.5	20	80	15	50	0	
10.0	20	80	15	50	0	

Surface Hoar Crystals





Howitzer Program

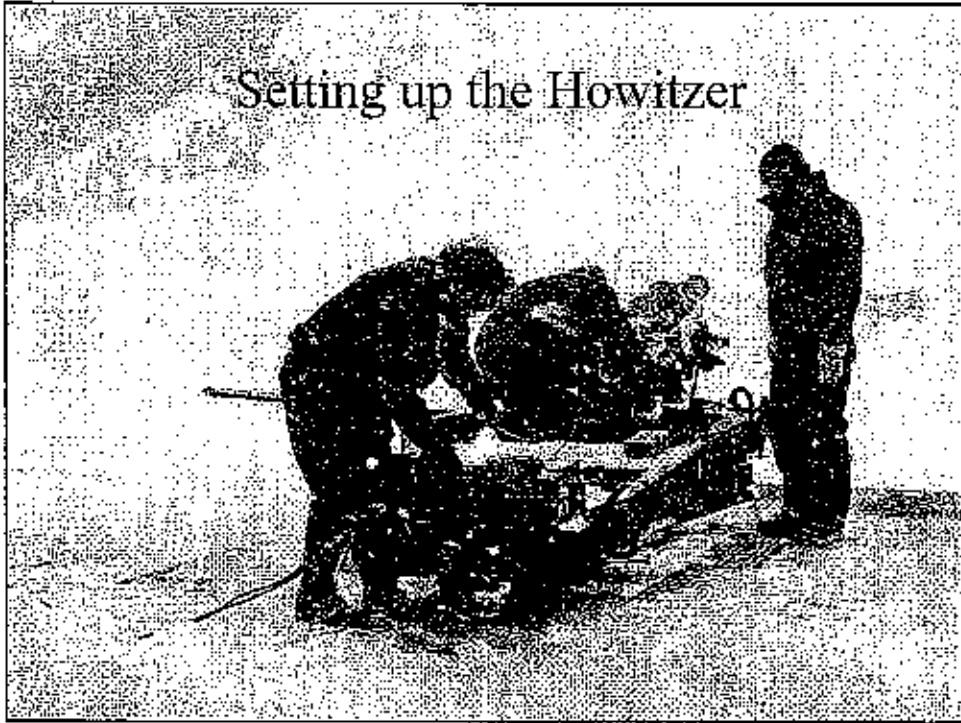
- Execution of Avalanche Control
- Training
 - Avalanche Artillery Users of North America Committee (AAUNAC)
- Howitzer maintenance and repair
- Ammunition
- Homeland Security



- Hazardous environment
- Control crew must cross FOUR avalanche run-out zones to reach the Howitzer platform
- All day commitment for 5-7 crew members
- Road closed from eight hours to multiple days

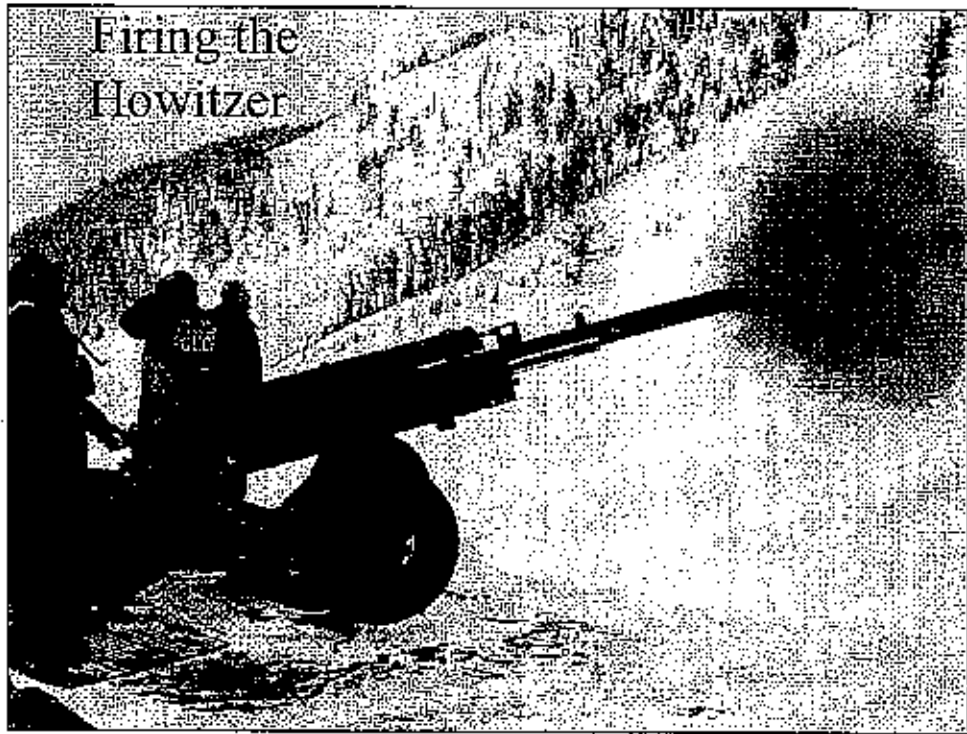
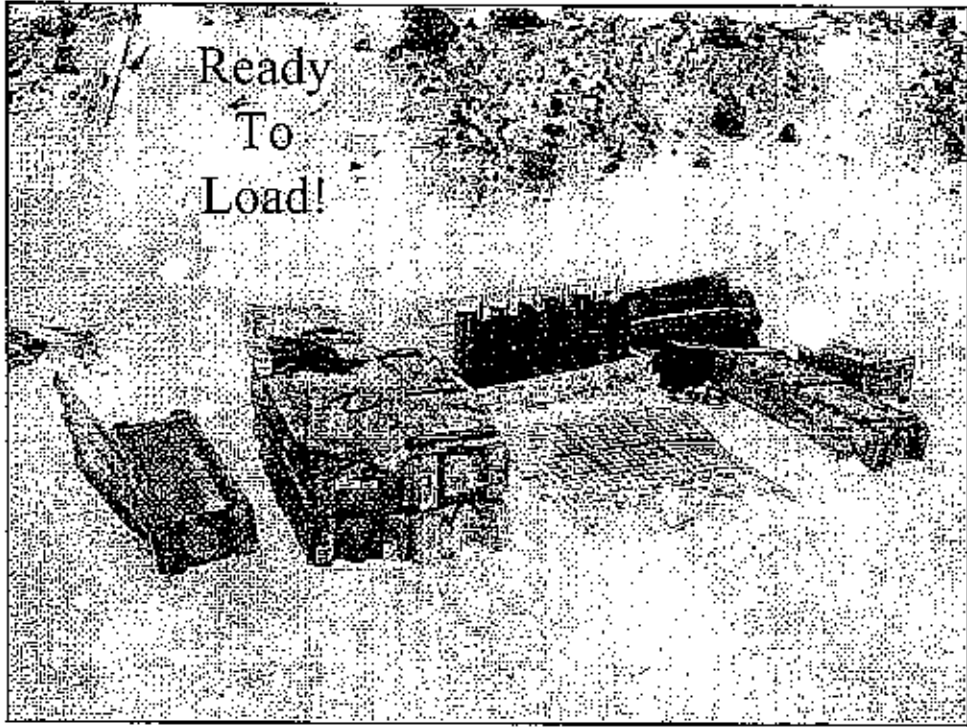
Run-out Zone

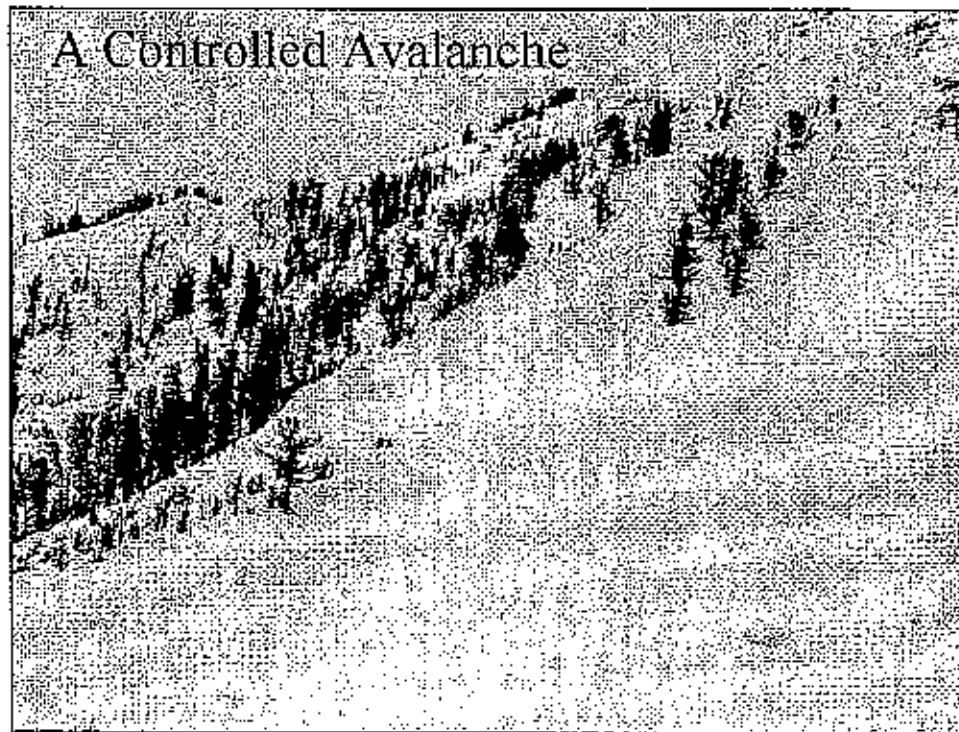
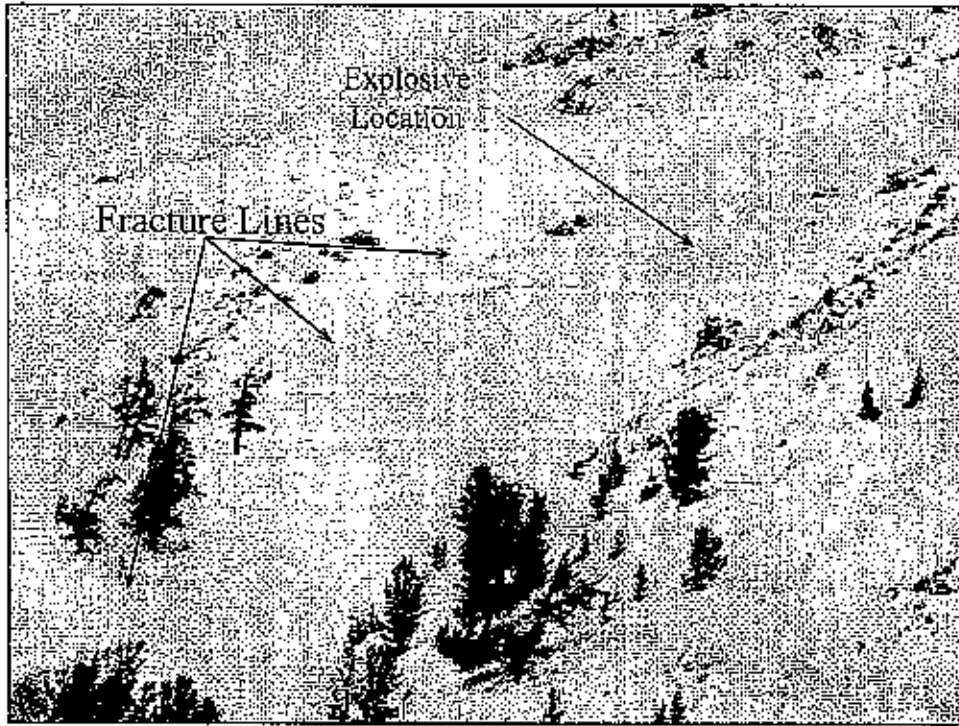
Setting up the Howitzer

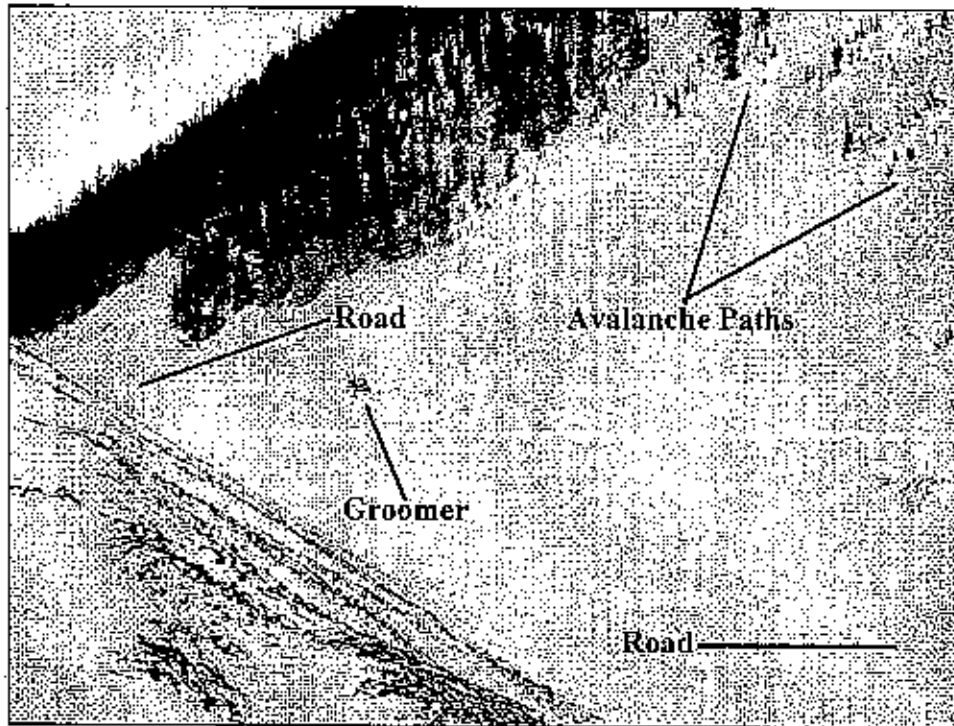


Building
Rounds









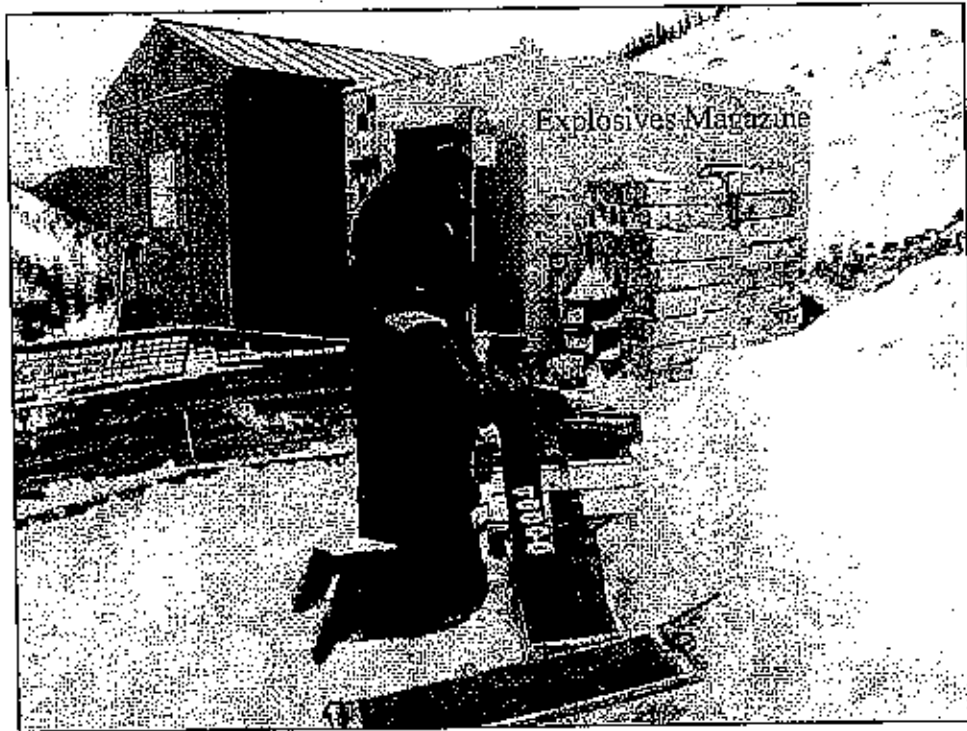
Training

- AAUNAC approved 3 day training every fall
- Ongoing training occurs throughout the course of the year
- Maintaining a qualified crew is essential to safely executing avalanche control mission
 - Employee turnover is a recurring problem

Howitzer Maintenance and Repair

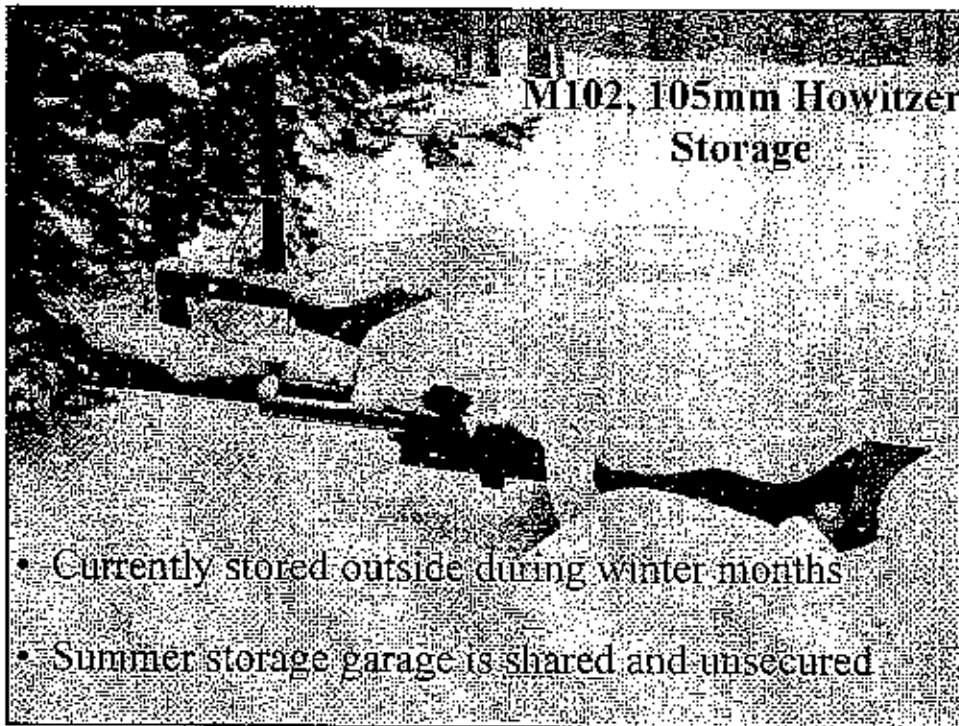
- The M102 Howitzer was not designed for use in a cold weather environment
- Recoil mechanism has been a weak point with the howitzer (\$40,000. replacement)
- The howitzer needs to be maintained year round and inspected by the military every fall





Homeland Security

- Howitzer Storage
- Magazine Security
- Ammunition Shipments
- Unsecured Duds

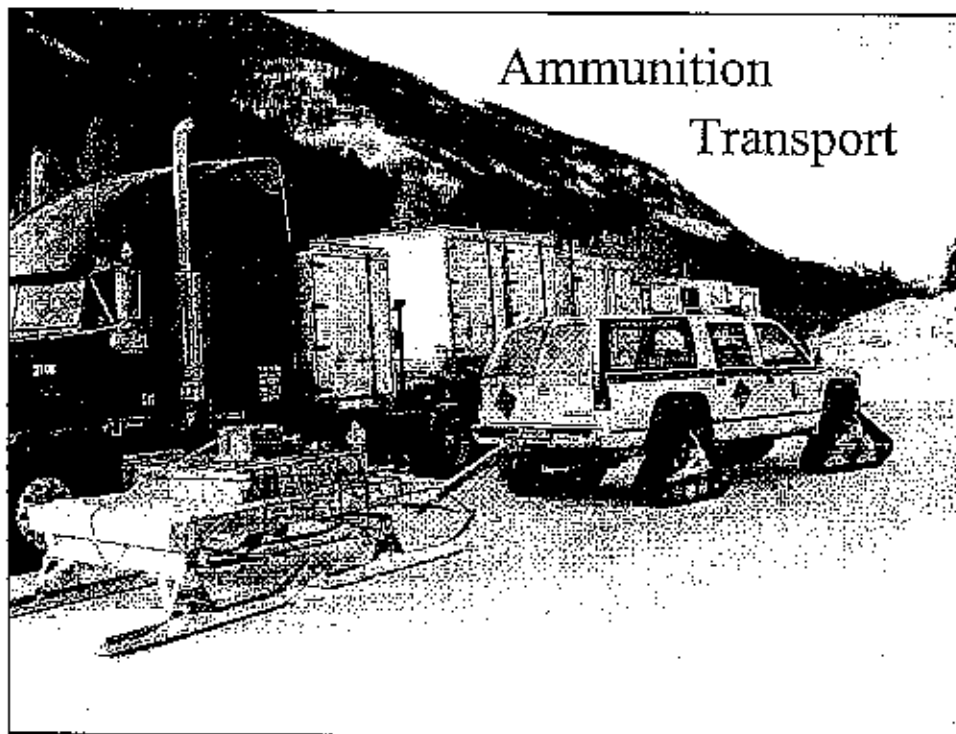


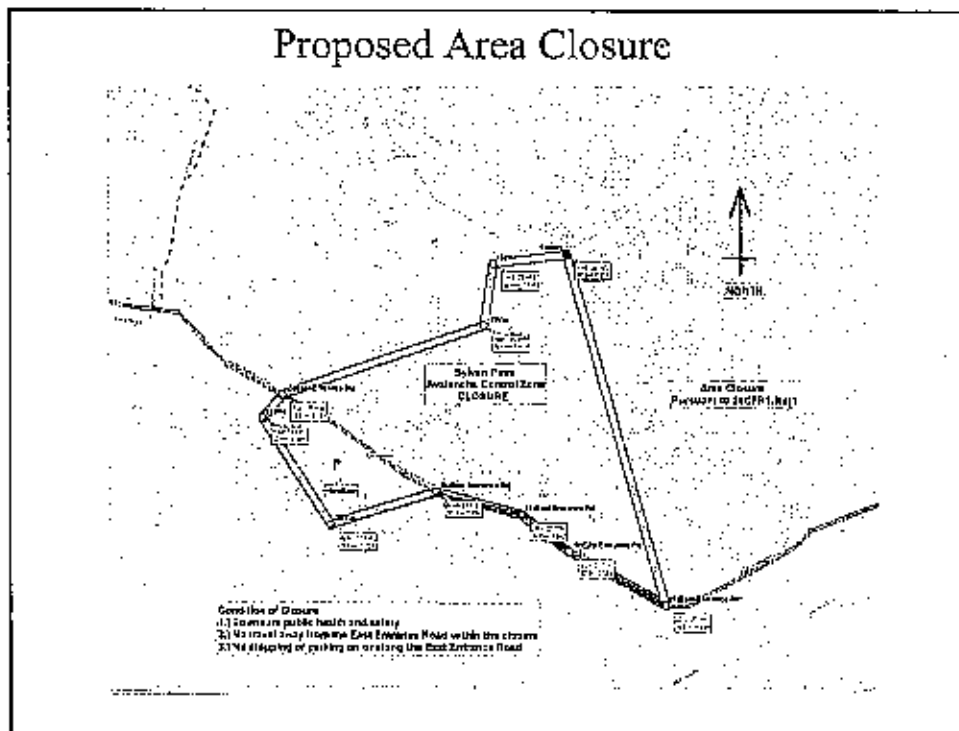
Ammunition Security

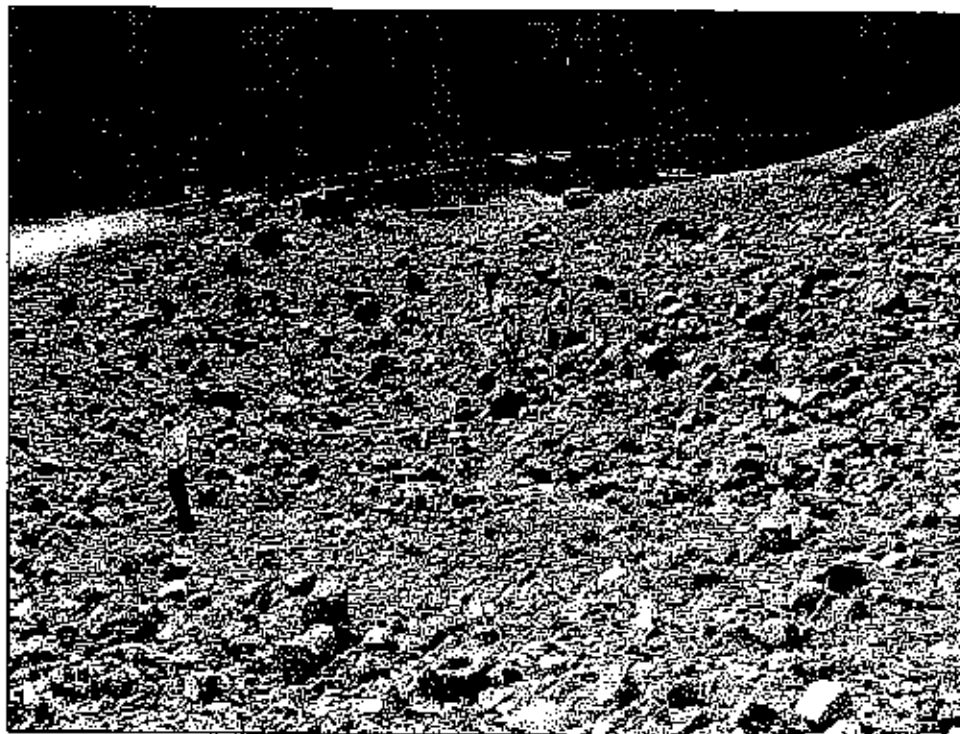
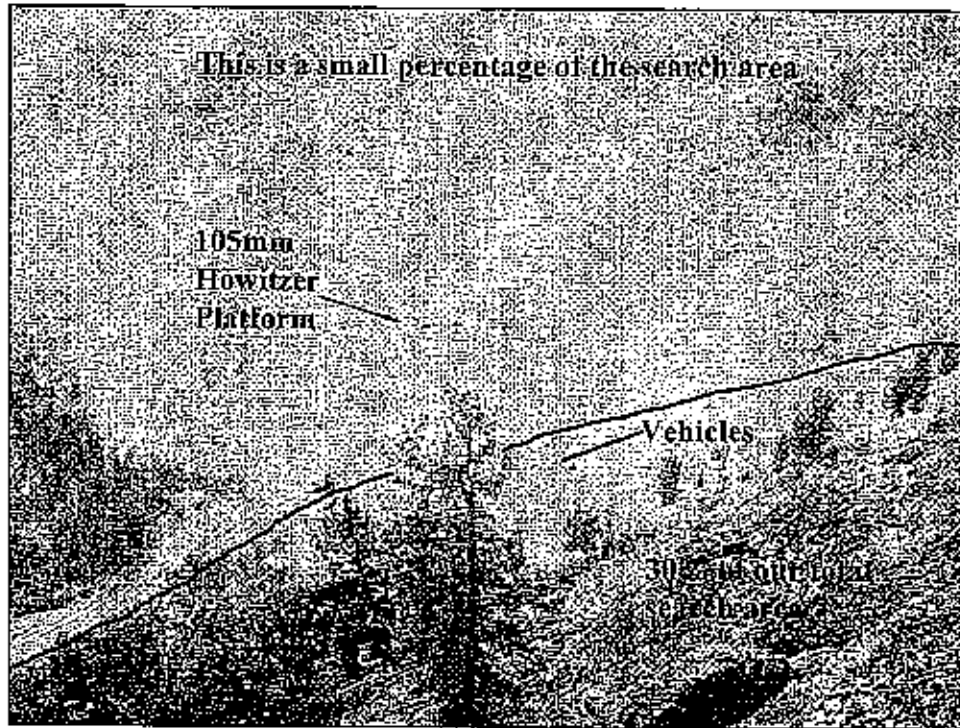
- Ammunition is stored on Sylvan Pass year round
- Weekly inspections are performed
- Monthly inventories are performed
- Security performed during ammunition transports

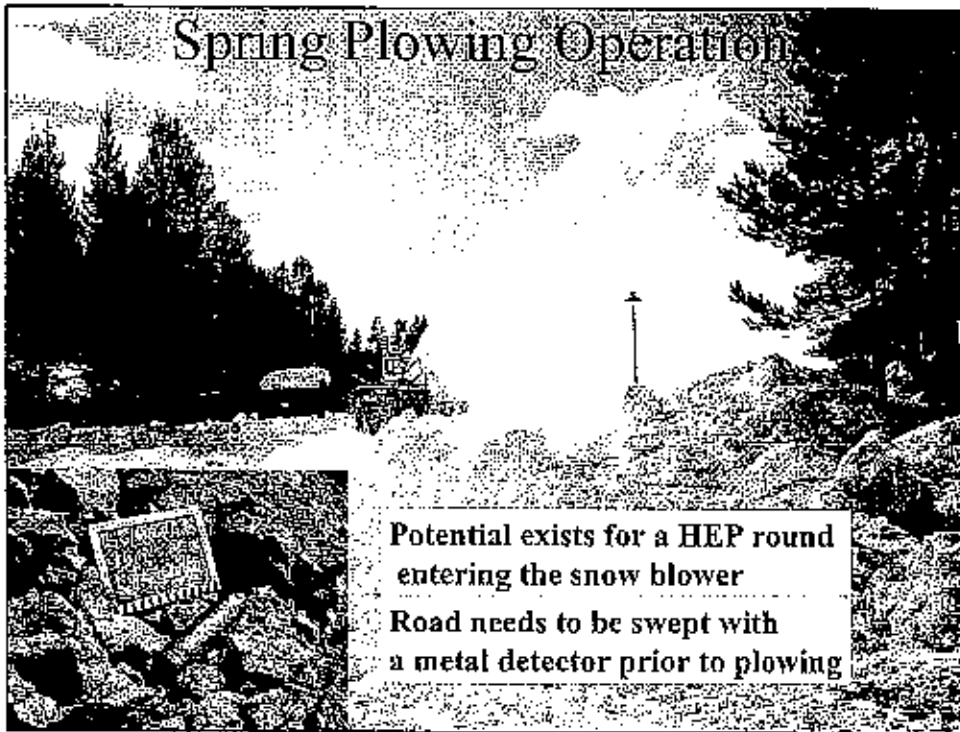
Ammunition

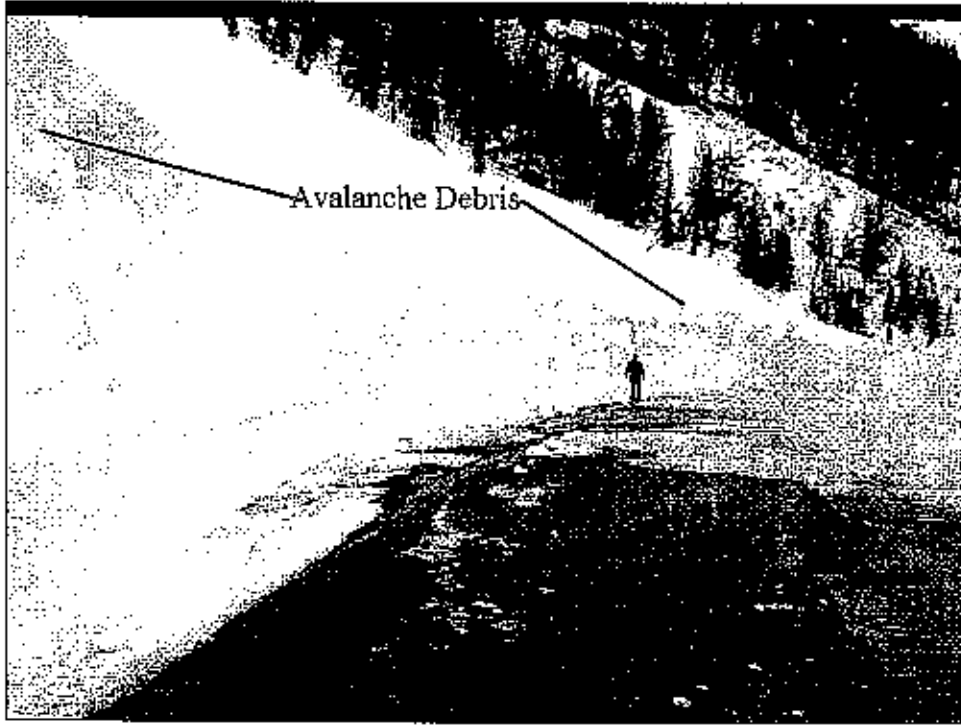
- 200 howitzer rounds fired every year
- 300 Rounds and fuzes stored on Sylvan Pass
- ATFE and NPS 65 require weekly and monthly inventories











General Information

- No Environmental Assessment completed for avalanche control operation using high explosive projectiles
- Approximately 200, 105m Howitzer rounds are fired each season
- As per military personnel, the comp-B explosive in the projectile is toxic when released into the environment after detonation
- State of Wyoming does not design snowmobile trails in avalanche terrain
- NPS groomer was struck by two avalanches during the 2003/2004 season
- 2003/2004 winter averaged 12 visitors per day through the East Entrance
- Cody to East Entrance is approximately 53 miles
- Cody to Northeast Entrance is approximately 72 miles

Visitor Use Issues

- **Sylvan Pass Closures**
 - Avalanche hazard - 24 to 48 hour closure
 - extreme avalanche hazard could close the pass indefinitely
 - Drifting and/or poor visibility and road conditions
 - snowcoaches can't travel over snow drifts that snowmobiles can
 - Stranded snowcoaches and snowmobilers at Lake with no facilities - lodging, restaurants etc.
 - Scheduled trips departing East Entrance have to be canceled
 - Scheduled trips departing South Entrance enroute to East Entrance have to be canceled.



Safety Concerns



Serious Injury or Death from Avalanche

- Snowmobiler
- Snowcoach - up to 15 individuals per vehicle
- Maintenance - Groomer operator
- Rangers - forecasting, road checks etc.
 - Ranger Robert E. Mahn died in an avalanche while checking the road January 19, 1994
- Howitzer crew



- Cross 4 major avalanche zones during high hazard to reach the gun and perform a mission
- Working with high explosives/military artillery
- Duds - Homeland Security, visitors



Sylvan Pass Management Criteria

- Visitor and Employee Safety
- Fiscal Impact to Communities
- Fiscal Impact to NPS
- Howitzer Program
- Homeland Security

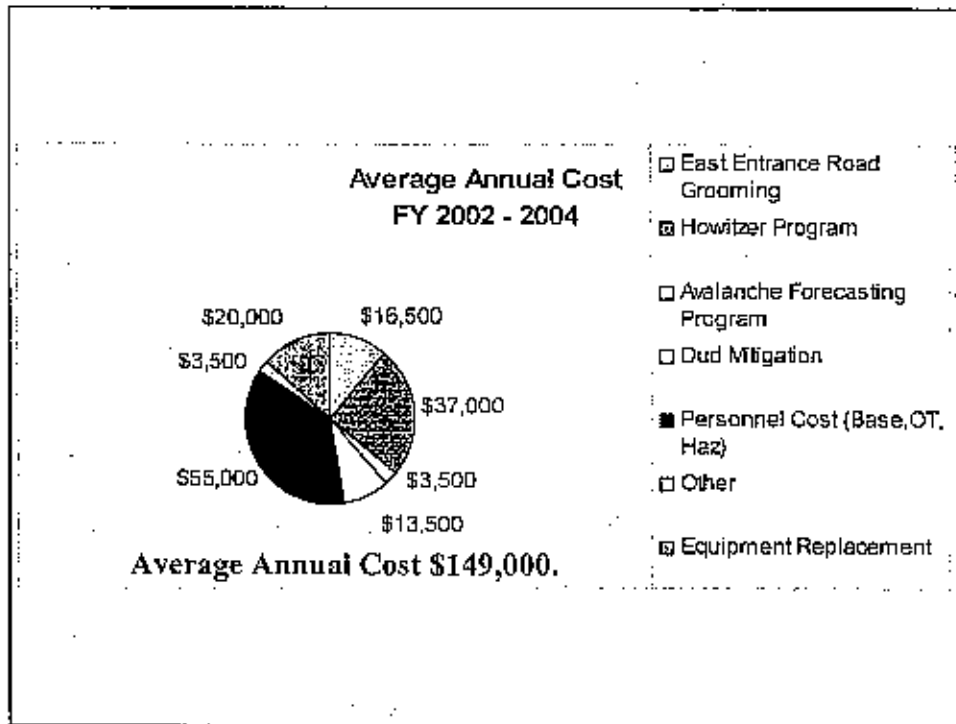
**Alternative 1
No Change to Operation**

- **Positive Impact**
 - Fiscal demands are predictable
 - Visitors can enjoy the Park
 - Cody and Jackson are not affected
 - Outfitters are not affected
 - NPS employees can reach homes in Cody
- **Negative Impact**
 - Serious hazards exist for visitors and employees
 - Security issues remain - howitzer, ammunition & duds
 - Current operation is not funded
 - Grooming standards cannot be met with current equipment
 - Potential for litigation as a result of serious injury or death
 - Potential for visitors to be stranded at Lake Village

**Alternative 1
Average Annual Costs**



Category	Item	Quantity	Unit Cost	Total Cost
Personnel	Director	1	\$100,000	\$100,000
	Deputy Director	1	\$80,000	\$80,000
	Chief of Park	1	\$70,000	\$70,000
	Chief of Administration	1	\$60,000	\$60,000
	Chief of Interpretation	1	\$50,000	\$50,000
	Chief of Maintenance	1	\$40,000	\$40,000
	Chief of Recreation	1	\$30,000	\$30,000
	Chief of Security	1	\$20,000	\$20,000
	Chief of Transportation	1	\$10,000	\$10,000
	Chief of Training	1	\$10,000	\$10,000
Contractors	Construction	100	\$100,000	\$10,000,000
	Maintenance	100	\$50,000	\$5,000,000
	Transportation	100	\$20,000	\$2,000,000
	Security	100	\$10,000	\$1,000,000
	Interpretation	100	\$5,000	\$500,000
	Administration	100	\$5,000	\$500,000
	Recreation	100	\$5,000	\$500,000
	Training	100	\$5,000	\$500,000
	Utilities	100	\$5,000	\$500,000
	Supplies	100	\$5,000	\$500,000
Equipment	Construction	100	\$100,000	\$10,000,000
	Maintenance	100	\$50,000	\$5,000,000
	Transportation	100	\$20,000	\$2,000,000
	Security	100	\$10,000	\$1,000,000
	Interpretation	100	\$5,000	\$500,000
	Administration	100	\$5,000	\$500,000
	Recreation	100	\$5,000	\$500,000
	Training	100	\$5,000	\$500,000
	Utilities	100	\$5,000	\$500,000
	Supplies	100	\$5,000	\$500,000



- Alternative 2
Close Sylvan Pass**
- **Positive Impact**
 - Limits serious hazards to visitors and employees
 - Reduce number of control mission with 105mm Howitzer
 - Fiscal savings
 - Maintain road to Lake Butte Overlook
 - East Entrance to Sylvan Pass maintained for X-Country Skiing
 - **Negative Impact**
 - Fiscal impact to the town of Cody and Jackson
 - Fiscal impact to established outfitters
 - Reduced opportunities to visitors
 - NPS employees with homes in Cody
 - NPS Contractors

Alternative 3

Manage for Increased Snowcoach Use

- **Positive Impact**
 - Increased visitor use
 - Cody, Jackson and outfitters benefit
- **Negative Impact**
 - Increase potential for mass casualty incident
 - Increase hazard to NPS employees
 - Increase cost to NPS operations
 - Security issues remain – howitzer, ammunition and duds
 - Potential for visitor to be stranded at Lake
 - Potential for litigation as a result of serious injury or death
 - Serious capital investment for NPS
 - Personnel
 - Equipment

Alternative 3

Equipment and Personnel Requirements

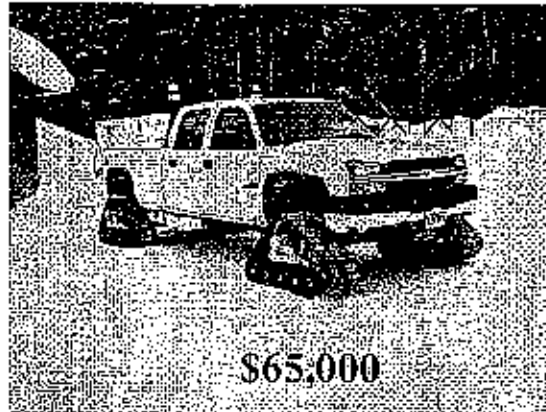
- **Additional Groomer**
 - Stationed on the pass to ensure a quick response.
- **Personnel**
 - 2 additional operators to guarantee daily grooming throughout the winter season



Alternative 3 Equipment and Personnel

- **Transportation**

- Transport visitors in the event of a disabled snowcoach
- Transport ammunition
- Reliable transport for mechanic to work on groomer



- **Avalanche Forecast**

- Weather station on Sylvan Pass \$8,000.

Alternative 3 Equipment and Personnel

- **Ambulance/Transport**

- One stationed at East Entrance and one at Lake Ranger Station.
- Eight passenger capacity
- Transport visitors in the event of a disabled snowcoach
- Can drive over avalanche debris
- Reliable transport of medical patients over Sylvan Pass



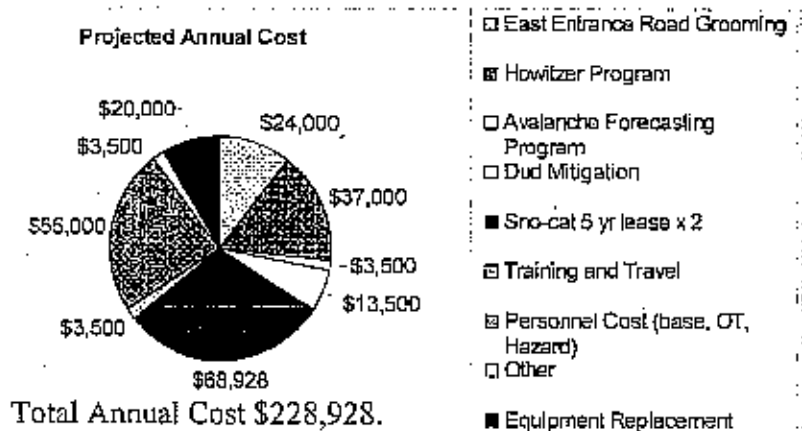
- **Personnel**

- One additional GS 09 Ranger for avalanche hazard forecasting, rescue coordination, howitzer team member.

Alternative 3 Initial Capital Investment Cost

• Additional Equipment	
– Groomer	\$150,000.
– Pick-up truck with Mattracks	\$65,000.
– Snowcoach/Ambulance x 2	\$260,000.
– Weather Station	<u>\$8,000.</u>
– Shelter for Groomer	\$50,000.
TOTAL	\$533,000.

Alternative 3 Projected Yearly Cost Summary



Alternative 4

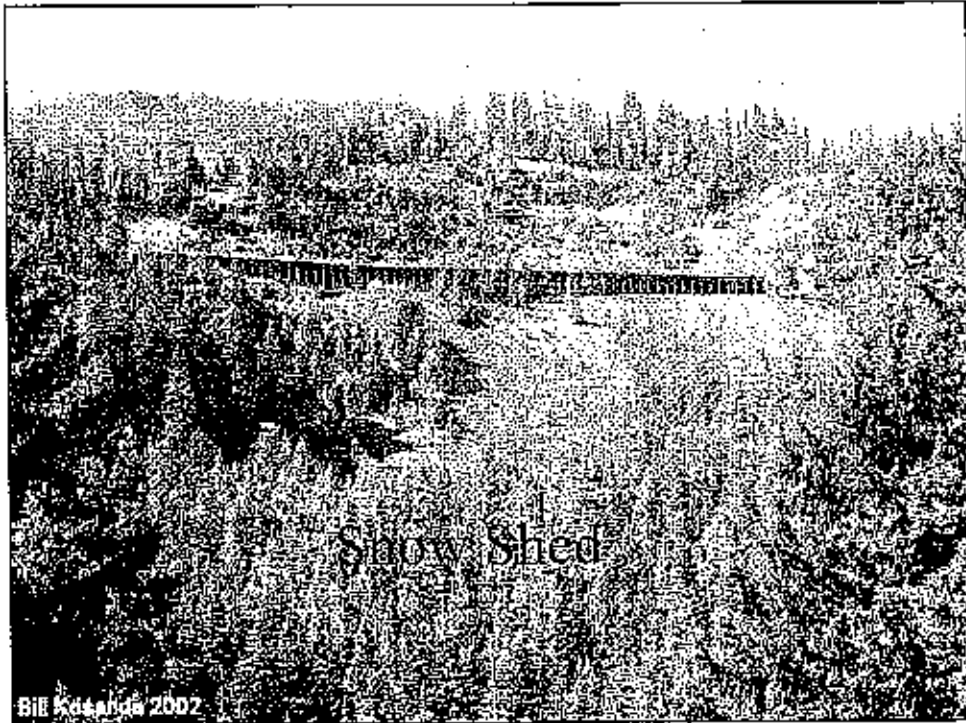
Close Sylvan Pass, Open Cooke Pass

- **Positive Impact**
 - Howitzer program, security issues etc. are terminated,
 - Serious hazards to visitors and employees eliminated
 - Fiscal savings
 - Maintain road to Lake Butte Overlook for snowmobile and snowcoach access
 - East Entrance to Sylvan Pass maintained for X-Country Skiing
 - Cooke Pass is vehicle access to Yellowstone NP and Lamar Valley from Cody
- **Negative Impact**
 - Fiscal impact to the town of Jackson
 - Fiscal impact to established outfitters
 - NPS employees with homes in Cody
 - NPS Contractors

Alternative 5

Snow Sheds

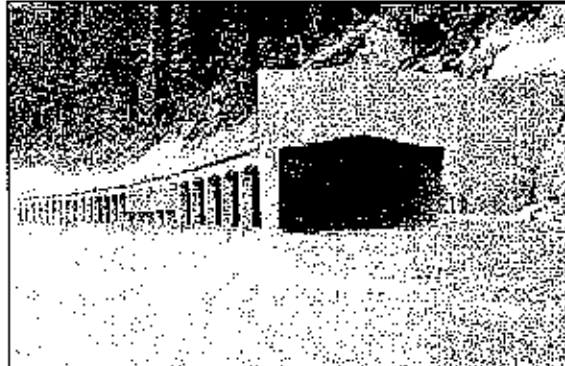
- **Positive Impact**
 - Road remains open
 - Howitzer program, security issues etc. are terminated,
 - Serious hazards to visitors and employees eliminated
 - Gateway communities and outfitters can rely on the road being open
 - No specialized equipment required
- **Negative Impact**
 - Federal Highway Cost Estimate FY 2000
\$16,000,000 (\$23,000 per meter)
 - NEPA Compliance Funded by FLHP (Federal Lands Highway Program)



Entrance to Snow Shed

Downhill side of the shed has a series of openings to facilitate lighting





Open Snow shed

Inside the Snow Shed

