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Presented By:

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THIN OVERLAY

Project Selection ▪ Design ▪ Construction

What is a Thin Overlay?

- **PRESERVATION TREATMENT**
- THIN = **1 to 1 ½”** Thick
- Overlay -or- apart of a Mill-and-Fill
- <u>Purpose</u> – mitigate distresses confined to the upper layer
- NOT intended to strengthen the pavement but improve functional problems…

Why Thin Overlay?

BENEFITS

- Long life and low life-cycle cost!
- Safety / User
  - Minimize traffic delays
  - Staged construction
  - Smooth surface
  - Restore skid resistance
  - No loose stones & minimizes dust
  - Lower noise
- Structural
  - Maintain grade & slope
  - Withstands heavy traffic
  - Easy to maintain
- Sustainable
  - Recycled materials
  - Seals surface & no binder run-off

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Why Thin Overlay?

BENEFITS

	Thin Overlay	Microsurfacing	Chip Seal
Corrects Surface Distress	X	X	X
Increases Skid Resistance	X	X	X
Minimizes Curb Loss	X	X	X
Eliminates Dust & Loose Aggregate	X	X	
Corrects Minor Rutting	X	X	
Improves Drainage	X		
Improves Ride Quality	X		
Requires ADA Improvements	X		

Project Selection

THE RIGHT STREET @ THE RIGHT TIME → Basic Evaluation

- Visual Survey
  - Crack Type/Depth
- Structural Assessment
  - Candidate streets should have minimal structural related distresses
- Drainage Evaluation
  - What changes are need?
  - Can a 1” lift fix these issues?
- Functional Evaluation
  - Ride Quality
  - Skid Resistance
- Other Maintenance Considerations??

Project Selection

DISTRESS TYPES/SEVERITY

Pavements in Fair to Good Condition

- Low to Medium **Raveling**
- Low to Medium **Longitudinal Cracking** (Not in Wheel Path)
- Short-Term Fix for **Longitudinal Cracking** in the Wheel Path
- Low Severity **Transverse Cracking** (Milling is Recommended)
- Low Severity **Rutting** < ½”
- Low **Skid Resistance**

Source: NCHRP Synthesis 464

Raveling

Longitudinal Cracking

NOT IN WHEELPATH

Longitudinal Cracking

WHEELPATH

Transverse Cracking

Alligator (Fatigue) Cracking

Requires Repair is < 20% of Area

Temporary Fix if Not Corrected

Rutting or Shoving

Severe Structural Failure

Surface Failure –
Milling Required

Ride Quality and Skid Resistance

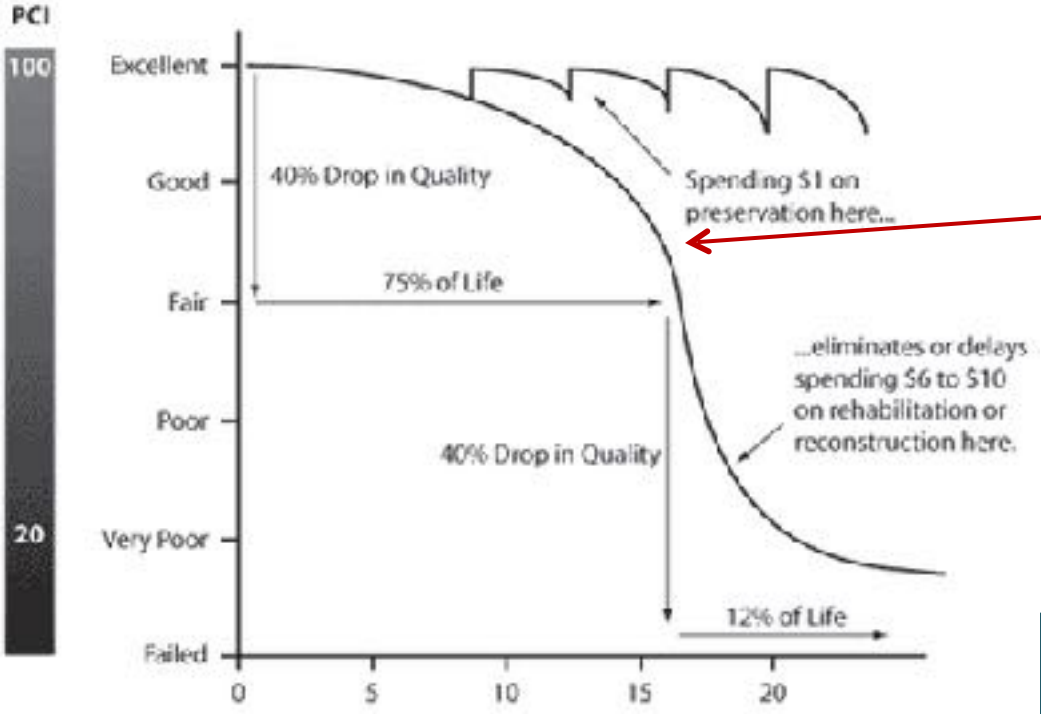
Rough surfaces should be milled

Skid problems can be milled, but not required

Project Selection

CANDIDATE PAVEMENTS SHOULD HAVE…

- Sufficient remaining structural capacity to last the life of the treatment
- No unrepaired structural damage
  - Full depth repair all fatigue cracking



Thin Overlay

Project Selection

WHERE NOT TO USE THIN OVERLAYS

- Widespread deep rutting > 0.5” deep
- Surface cracks wider than 3/8”
- Areas of existing extensive, deep patching
- More than 20% by area has moderate to severe alligator cracking
- Areas where layer debonding or subsurface stripping is suspected (needs further investigation to verify)
- Areas of severe bleeding/flushing…unless milled first

Design

PAVEMENT STRUCTURE

- Timely Thin Overlay Can Save Your Structure

- **WHAT IS AN INCH…**

Design

PAVEMENT STRUCTURE

- **WHAT IS AN INCH??**

Asphalt Thickness vs. Fatigue Life

Thickness (inch)	Micro Strain	Traffic Loading (ESAL Repetitions to Failure)
2	-652	30,234
3	-495	71,537
4	-383	160,693
5	-302	340,507
6	-242	682,133

Design

PAVEMENT STRUCTURE

- 1 inch overlay of an existing 4 inch pavement will double the fatigue life
- Second 1 inch overlay can extend the structural life beyond 50 years
- Once you achieve a perpetual thickness you can focus on managing at the surface for functional attributes as your structural worries are over

As Jim Huddleston would say, “building perpetual pavements, one inch at a time”

Design

PAVEMENT STRUCTURE

- Do you need a full pavement evaluation with all of the bells and whistles?
  - Coring/ Subsurface Explorations
  - DCP
  - GPR
  - FWD
- Do you need to perform a Structural Design?
  - AASHTO 1993
  - AASHTO MEPGD
  - Asphalt Institute
- MIX DESIGN IS KEY…

Design

MIX DESIGN - Aggregate

- Mix design criteria to optimize preservation needs
  - Small Nominal Max Aggregate Size (NMAS)
    - Aggregate size between **4.75 and 12.5 mm** NMAS
    - Ratio of lift thickness to NMAS range 3:1 to 5:1
  - Quality
    - LA Abrasion: 35–48 maximum
    - Sodium Sulfate: 10–16 maximum
    - CA Fractured Faces (does not apply to 4.75 mm)
      - 2 or More: 80–90
      - 1: 10–100
    - Sand Equivalent: 28–60
    - FA Angularity (Uncompacted Voids): 40–45

Design

MIX DESIGN - Binder

- Select binder grade based on climate and traffic
  - Binder selected to optimize crack resistance
    - softest binder that passes rut test
    - polymers for highest demand areas & slow reflective cracking
  - RAP and RAS combined with softer base binders to provide cost savings

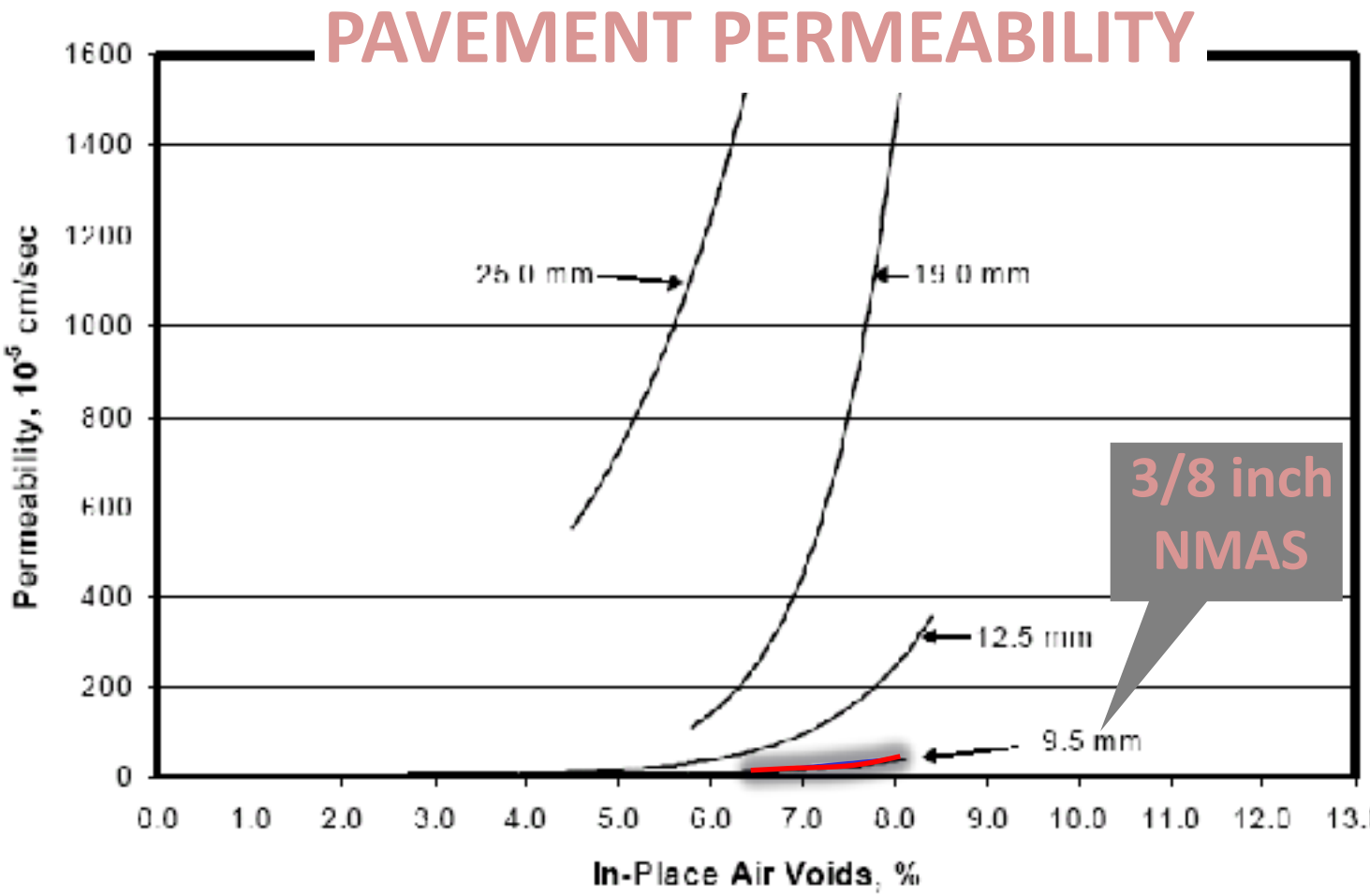
Design

MIX DESIGN

- Mix design criteria to optimize preservation needs
  - Gyration levels to match traffic and local practice
    - Generally 50-80
    - Enough compaction for interlock w/o fracturing aggregate
  - Va, (4% +/- 1%)
  - VMA (>= 15%)
  - VFA (65-80%)
  - Avoid low VMA high dust mixes
  - Dust/Asphalt Ratio (0.6-1.6)
  - Minimum binder content 6% +
    - Will depend on Voids & VMA

Design

MIX DESIGN



Reduced permeability improves pavement longevity by protecting the pavement from the damaging effects of air and moisture intrusion.

Source: NCAT Research Synopsis 03-02

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Construction

SURFACE PREPARATION

- Repair fatigue cracking &/ potholes
- Seal cracks > 5/16 inch (fill 1/8” below surface)
- Repair drainage deficiencies
- Milling
  - If widespread top-down cracking
  - If Poor ride quality
  - If rutting is due to mix deficiencies, studded tire wear, or post construction consolidation
  - Improves bonding
- Tack Coat

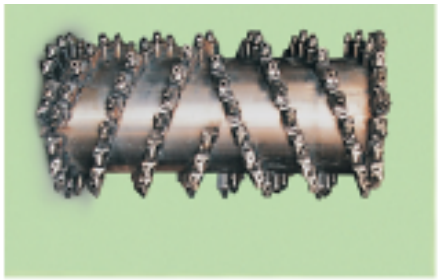
Surface Preparation

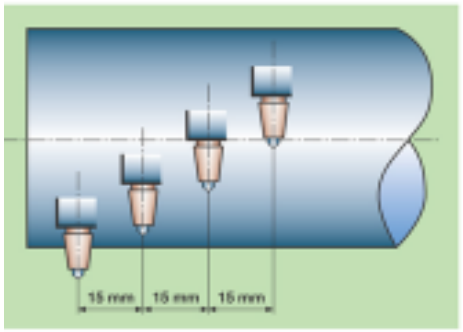
	Mill	Fill Cracks	Clean and Tack
Raveling			
Long. Crack – not in w.p.			
Long. Crack – w.p.			
Transverse Crack			
Alligator Crack			
Rutting			

Construction

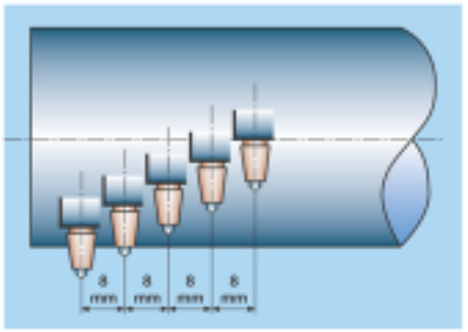
MILLING

- Standard Milling
- Fine Milling
- Micro Milling

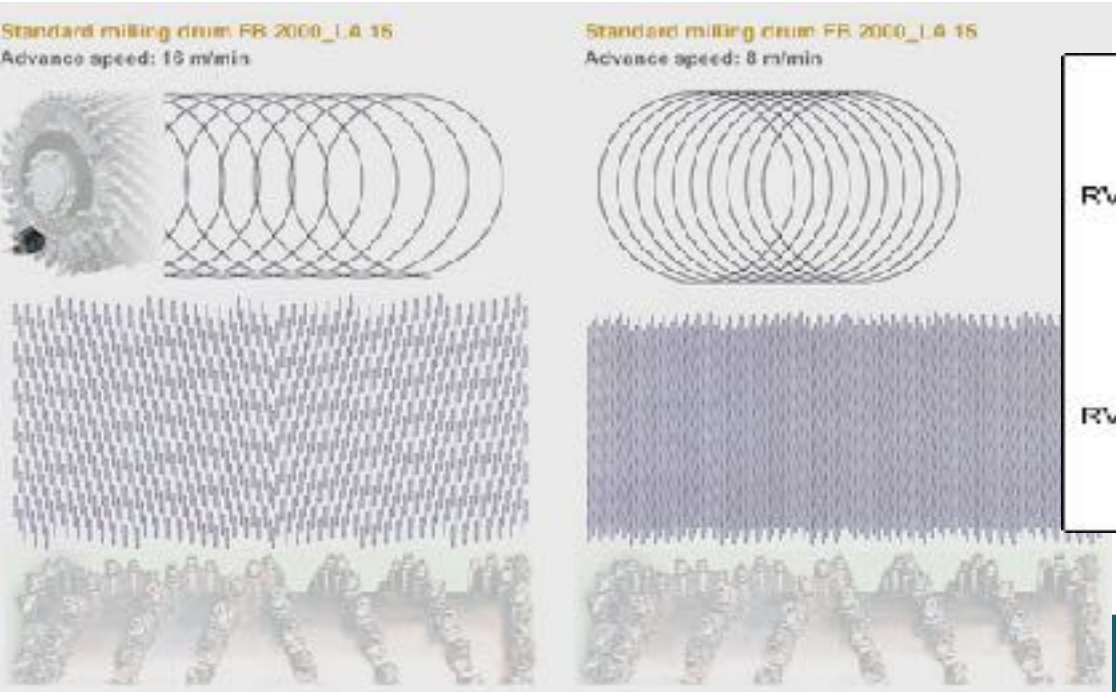


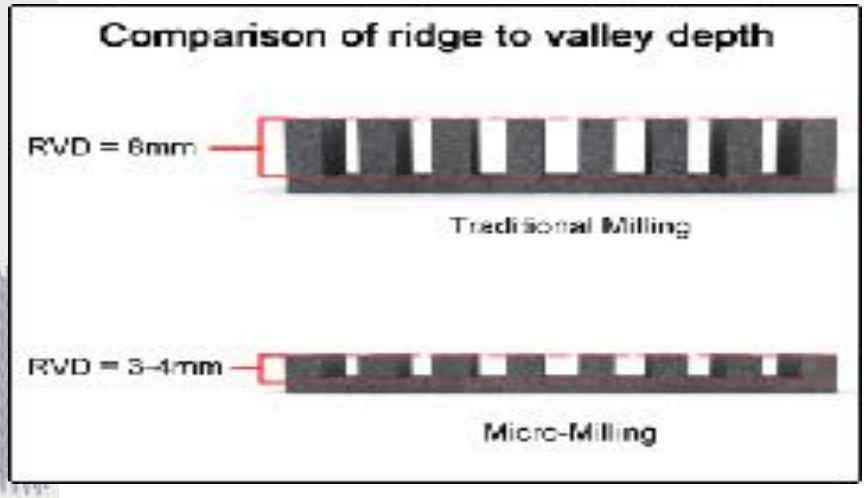


Standard milling drums with a spacing of 15 mm are eminently suitable for removing complete road pavements.



The fine milling drums with a spacing of 8 mm are ideal for treating the surface of pavement courses.





Construction

MILLING

Standard Milled Surface

Fine/Micro Milled Surface

Construction

TACK COAT

- Applied to clean and dry surface
- Uniformly applied and at the proper rate
  - 0.10 to 0.15 gal/sy (undiluted emulsion)
- Properly cured prior to placement

Construction

AT THE PLANT

- Thin lift mixes are composed of a high percentage of fine aggregate
- Fine aggregate stockpiles have higher moisture contents than coarse aggregate stockpiles
- Attention must be given to the proper drying of all aggregates, which may mean slowing down
- Moist aggregates contribute to stripping and also tenderness issues with mixes
  - Avoid running the plant at higher temps to dry aggregate, this will prematurely age the mix

Construction — Production

PRODUCTION

- RAP – Process for size and consistency
  - Max size ≤ NMAS
- Storage and Loading
  - Follow normal best practices
- Warm Mix
  - Increase haul distance
  - Pave at cooler temperatures
  - Achieve density at lower temperatures
  - Extend paving season
  - Pave over crack sealer

Construction

PRODUCTION

- Paving
  - Best to move continuously
  - MTV or windrow can help
  - Cooling can be an issue
    - 1” cools 2× faster than 1.5”
- Compaction
  - Seal voids & increase stability
  - Low permeability
  - No vibratory on < 1”

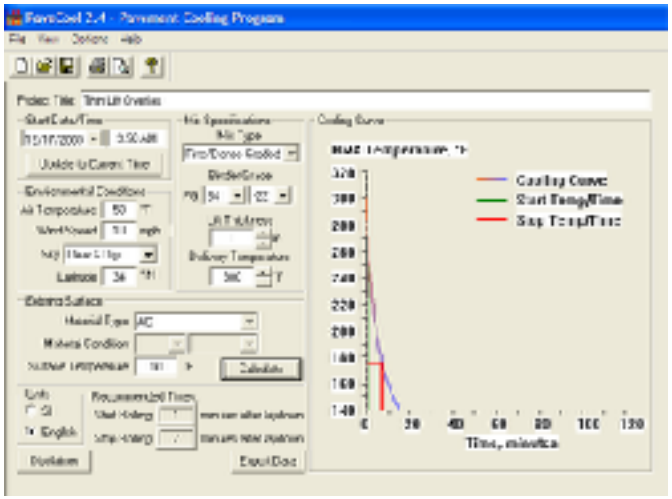
Construction

COMPACTION

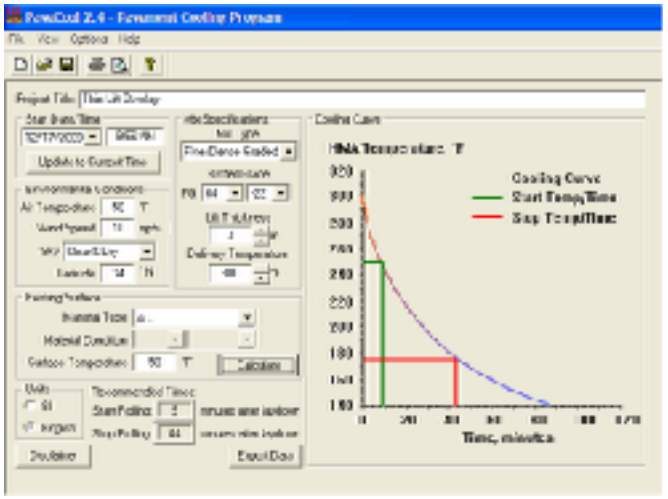
- Don’t let the paver leave the rollers behind
- Thin lifts cool RAPIDLY and need to be compacted more Quickly
  - PAVECOOL Software → Time to Complete Compaction

50F Air Temp + 300F Mix Temp

1 inch = 7 min



3 inch = 44 min



Construction Sequence

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Construction Sequence

Construction Sequence

Performance

Location	Traffic	Underlying Pavement	Performance, yrs.
Ohio	High/Low	Asphalt	16
	Low	Composite	11
	High	Composite	7
North Carolina	—	Concrete	6–10
Ontario	High	Asphalt	8
Illinois	Low	Asphalt	7–10
New York	—	Asphalt	5–8
Indiana	Low	Asphalt	9–11
Austria	High/Low	Asphalt	≥10
	High	Concrete	≥8
Georgia	Low	Asphalt	10

Cost

2008 NAPA Survey of State Asphalt Associations

Treatment	Expected Life, yrs	Range	Cost, $/SY	Range	Annual Cost, $/lane-mile
Chip Seal	4.08	2.5–5	2.06	0.50–4.25	3,554.51
Slurry Seal	3.25	2–4	1.78	1.00–2.20	3,855.75
Micro-surfacing	4.67	4–6	3.31	2.30–6.75	4,989.81
Thin Surfacing	10.69	7–14	4.52	2.40–6.75	2,976.69

TABLE 2 Typical Unit Costs (2009) and Pavement Life for Specific Maintenance and Preservation Treatments *(2)*

NCAT

Treatment	Initial Costs $/sq.yd.	Expected Extended Life of Pavement, yrs	Annualized Cost $/sq.yd/yr
Crack Treatment	0.32	2	0.16
Fog Seals	0.99	4	0.25
Chip Seals	1.85	6	0.31
Microsurfacing	3.79	6	0.63
Slurry Seals	4.11	5	0.82
Thin HMA Overlay	5.37	13	0.41

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Summary

- **Thin Overlay = Preservation**
- Proper Project Selection is Key
  - Structurally sound pavements only
- Mix Design
  - Not your typical DOT Mix
- Construction Considerations
  - Paving Moves FAST
  - Keep the rollers right behind the paver

THANK YOU!

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Thanks to APAO, NAPA, NCAT for slides and photos