Why are we here?

- Protect Flight hardware
- NASA independent audit
- Avoid more paper
- Answer question
When we torque a bolt where does it go?

50% of the torque applied is used up in overcoming the nut bearing friction
40% of the torque applied is used to dissipate the thread friction
10% of the torque is used to raise the load “generate preload”

Variations in the coefficient of friction have a huge effect upon the preload

Aerospace threaded fasteners are pre-lubed to try and control the friction coefficient. These include: Cadmium plating, silver plating, cetyl alcohol, dry film lube

NO GREASE!
What happens when we torque a bolt?

- We apply a torque to the nut
- The nut turns
- The bolt stretches
- Creates preload on the joint
What affects a bolt's torque?

- Friction
- Bolt coating and lubricants
- Running torque of the locking device
- Surface condition of the mating parts
- Soft goods or gaskets
Shop Responsibilities

- Torque pattern
- Incremental torque
- Torque value
- Thread protrusion / engagement
- Fastener Substitutions
- Running torque
- Fasteners in good condition
- No lube
Why we use torque Pattern

• Allows all fasteners in a joint to take the load evenly
• Prevents uneven tightness
• Extremely important in soft goods
Incremental torque/ final value

- Incremental
  - 2 less than .250”
  - 3 .250” or greater

- Final torque
  - Midrange when torqueing nut
  - High end for head side or fastener with retorque
Protrusion or Engagement

• Inserts
  – 3 full turns after engaging the locking

• Bolts/ Screws
  – Equivalent of 1 thread beyond the nut
  – 2-3 full turns beyond the the locking feature in blind locations
Running torque

- Running torque/locking torque shall be verified in all installations
- For smaller fasteners it is not much more than felt resistance
What is shank-out? What is tread protrusion?

IDEAL CONDITION
RUNOUT ANGLE ALIGNED WITH HOLE EXIT

THREADS IN BEARING
NOT ACCEPTABLE

BOLT SHANK PROTRUDES THRU STRUCTURE NOT ACCEPTABLE IF NUT BOTTOMS OUT ON BOLT RUNOUT

EXAMPLE:
1/4-28
28 TPI
P = 1/28 (.0357 in.)
Rules of fastener use

- Fasteners with a shank may be up or down 1 grip
- All thread fasteners up or down two grips
- 1 or 2 washers may be added of same basic part of existing washer may be used
- “L” series washers are acceptable
- Not allowed in blind areas unless the hole is measured
- Blind location must be documented
- May combine 1 & 2
- If 2 or more washers are called out washer removal is allowable provided 1 remains
Are gaps under the head allowable

Allowable if you can you install a .002 shim and not contact the shank?

Gap is allowable up to 40% of the circumference.
Closing

• Questions