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What's New in the ASME Y14.5M-2009 for SolidWorks Users

November 10, 2009

Thomas Allsup

Take Me to the Pilot of This Song

- *Thomas Allsup*
- *Co-chair of North Texas SolidWorks User Group*
- *BSME 1987 Oklahoma State University*
- *MSME 1990 University of Texas at Arlington*
- *I took my first real GD&T course in 1998 and have been teaching it ever since*
- *I took my first SolidWorks class at Christmas 1999 using SolidWorks 1998 and have been using it ever since*

Save Me

- *This presentation is available for immediate download at our website*
- *www.anidatech.com/SWTechGDT.ppt*
- *Those of you who can stay awake will notice that each slide of this presentation has a song title – there's an answer sheet at the end if you can't remember the artist…*
  - *For those who have been through my prior presentations, I like it when a presentation flows like a song – this presentation does not by a long shot hence the song titles to make you forget.*

Dance With The One Who Brought You

- *Richard asked that I add more SolidWorks content and since this is a SolidWorks technical summit it didn't seem that odd of a request.*
- *Look for slides with a yellow background for SolidWorks specific information.*

What a Long Strange Trip It's Been

- *The ASME took over the publication of the standard from ANSI in 1989.*
  - *I still cringe when I hear people say they know ANSI GD&T, it is kind of like saying you know Latin as you try to speak Spanish*
- *1994: slightly updated with the biggest change being the addition of metric dimensions hence the "M" in the title.*
- *1999: reaffirmed without changes.*
  - *This is the GD&T standard that an entire generation has used for creating and interpreting drawings.*

Remember the Good Times

- *This year, the standard was changed significantly for the first time since 1994.*
- *Introducing the new ASME Y14.5M-2009!*

Ch-ch-ch-changes

- *New standard has new symbols & refines some existing terms but the most obvious change is the order & segregation of the 5 types of controls.*
  - *FOPRL will be coming up soon…*
- *Maybe someone on the Y14 committee does listen to us users after all*
  - *Actually there are quarterly meetings & lots of opportunities to comment on all the drawing standards.*

Old Flame

- *Before we discuss the changes, an obvious question is do we have to learn the new standard?*
  - *If you create all your own drawings and never get drawings from customers then you can keep using the old standard.*
  - *If you are like me and have to interpret whatever is thrown at me then you need to buy and start studying the new standard.*
- *We'll mention this later but don't throw your old standards away.*

Cover Me

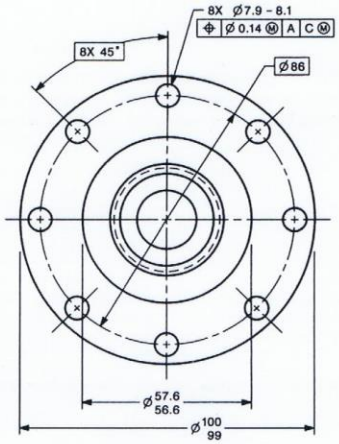
- *Let's start with the cover.*
- *Previously the front picture was datums on the bluish green color background*
  - *(Hey, I'm in San Antonio that color is AQUA).*
- *Now the cover is almost completely white with a blue strip at the top and bottom and a simple relatively small figure of a drilled flange with a single position GD&T tolerance.*

ASME Y14.5-2009

[Revision of ASME Y14.5M-1994 (R2004)]

Dimensioning and Tolerancing

Engineering Drawing and Related Documentation Practices



AN INTERNATIONAL STANDARD

The American Society of Mechanical Engineers

ASME SETTING THE STANDARD

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Who Needs Pictures?

- *When you start using the new standard, your drawing formats should be revised to have words like:*
  - "Interpret this drawing using ASME Y14.5M-2009"
- *Don't throw your old standard away:*
  - You might need it to interpret the drawings you created or receive from others that were created from 1994 to 2009.
  - Don't use the drawing date to determine what standard to use, look for the note on the drawing.

I Walk The Line

- *In this session, we do not have time to go line by line with the changes but I will try and point out the biggies like the new symbols and the redefined terms.*
- *ASME offers a full 8 hour seminar discussing every minute change.*
  - *Hey, who added that comma?*
- *Appendix A of ASME Y14.5M-2009 has a list of every change.*

This Song Has No Title

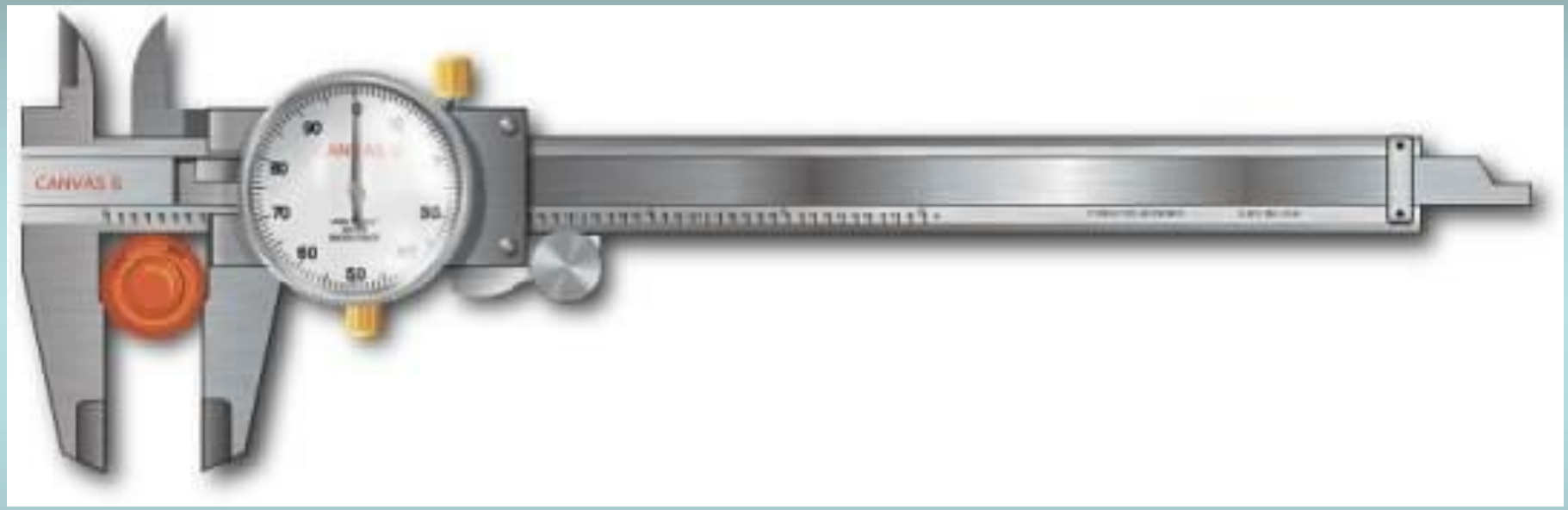
- *In Section 1.2.1 Cited Standards now has ASME Y14.41-2003 (reaffirmed in 2008) Digital Product Definition Data Practices.*
  - Provides guidance to 3D model with embedded dimensions and tolerances.
- *Numerous new citations back to this standard.*
  - This topic came up in Austin during one of my Primer lectures and I wanted to mention that the embedded 3D data has been allowed since 1984 but now it is really well documented.

Material Girl

- *Section 1.3.3,1.3.4, and 1.3.49 introduce new datums terms for*
  - Least Material Boundary
  - Maximum Material Boundary
  - Regardless of Boundary Size
- *The symbols are the same for features.*
- *Features will continue to use the terms LMC, MMC, and RFS.*

Big 'Ol Truck

- *Section 1.3.32.2 introduces the new term "Irregular Feature of Size"*
- *We've always had features of size*
  - *Remember the "caliper test"?*
  - *Cylindrical surface*
  - *Spherical surface*
  - *Two opposed parallel elements or surfaces*
- *These are now called "regular" features of size*
- *Now we get to introduce "Irregular" Features of Size*


CANVAS II

Shapes of Things

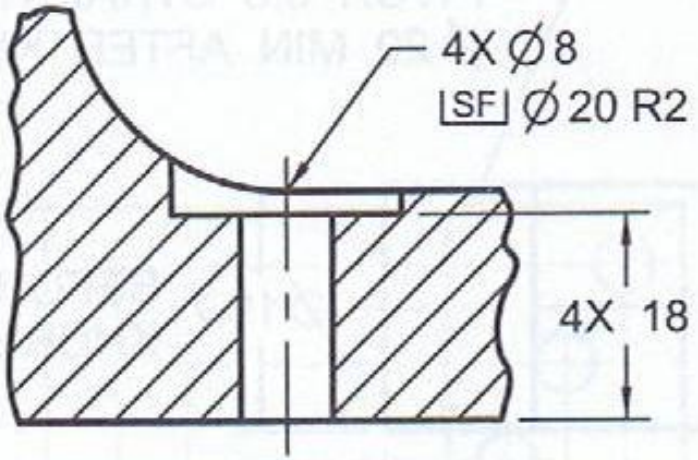
- *Now an arbitrary profile can be identified as a datum.*
- *If that profile follows the “caliper test” then material modifiers can be applied.*
- *Imagine extruded shape profiles, key holes, splines, or other unusual shapes now being able to be considered a datum.*

Love is a Bore

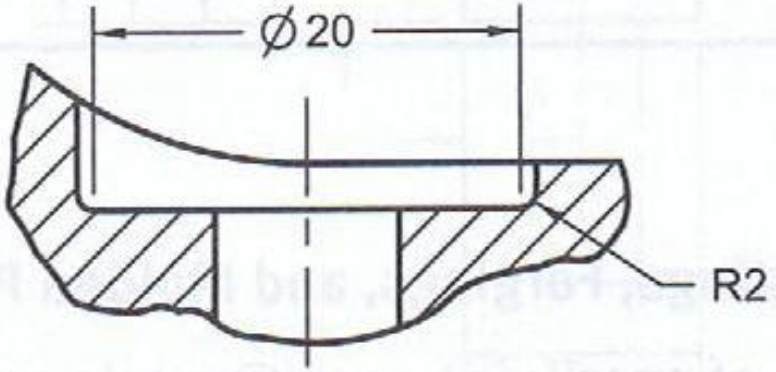
- *Section 1.8.14 Spotfaces now have a new symbol that is a counterbore symbol with "SF" inside the symbol.*
  - *Previously it was the same as the counterbore with no depth specified.*
- *Spotfaces used to use the same symbol as a counterbore with only the depth missing.*
- *Now you can also add a radius to the edge of the counterbore as well as the main diameter.*

Fig. 1-41 Spotfaced Holes

This on the drawing



Means this



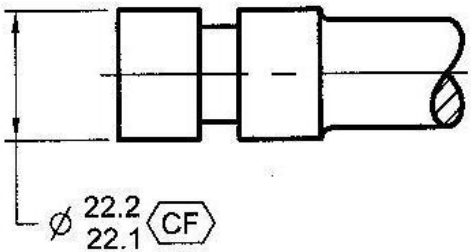
3.3.13
1.8.14

The Continuous Life

- *Section 2.7.5 adds a new phrase "CONTINUOUS FEATURE"*
- *There is a new symbol for this as well, the letters CF in an irregular hexagon.*
- *A Continuous Feature is two of more features of size that are not contiguous (touching) but wish to be treated as a single surface.*
  - *Example: A shaft with grooves cut into it. The main shaft could be called a single continuous feature.*

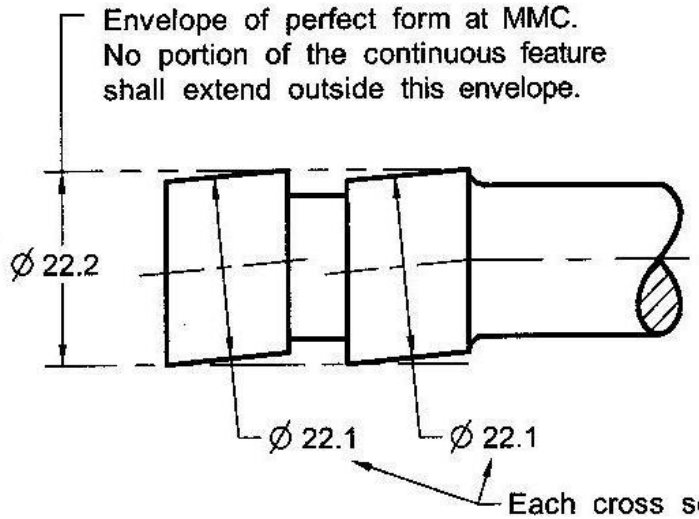
Fig. 2-8 Continuous Feature, External Cylindrical

This on the drawing



3.3.23
2.7.5

Means this

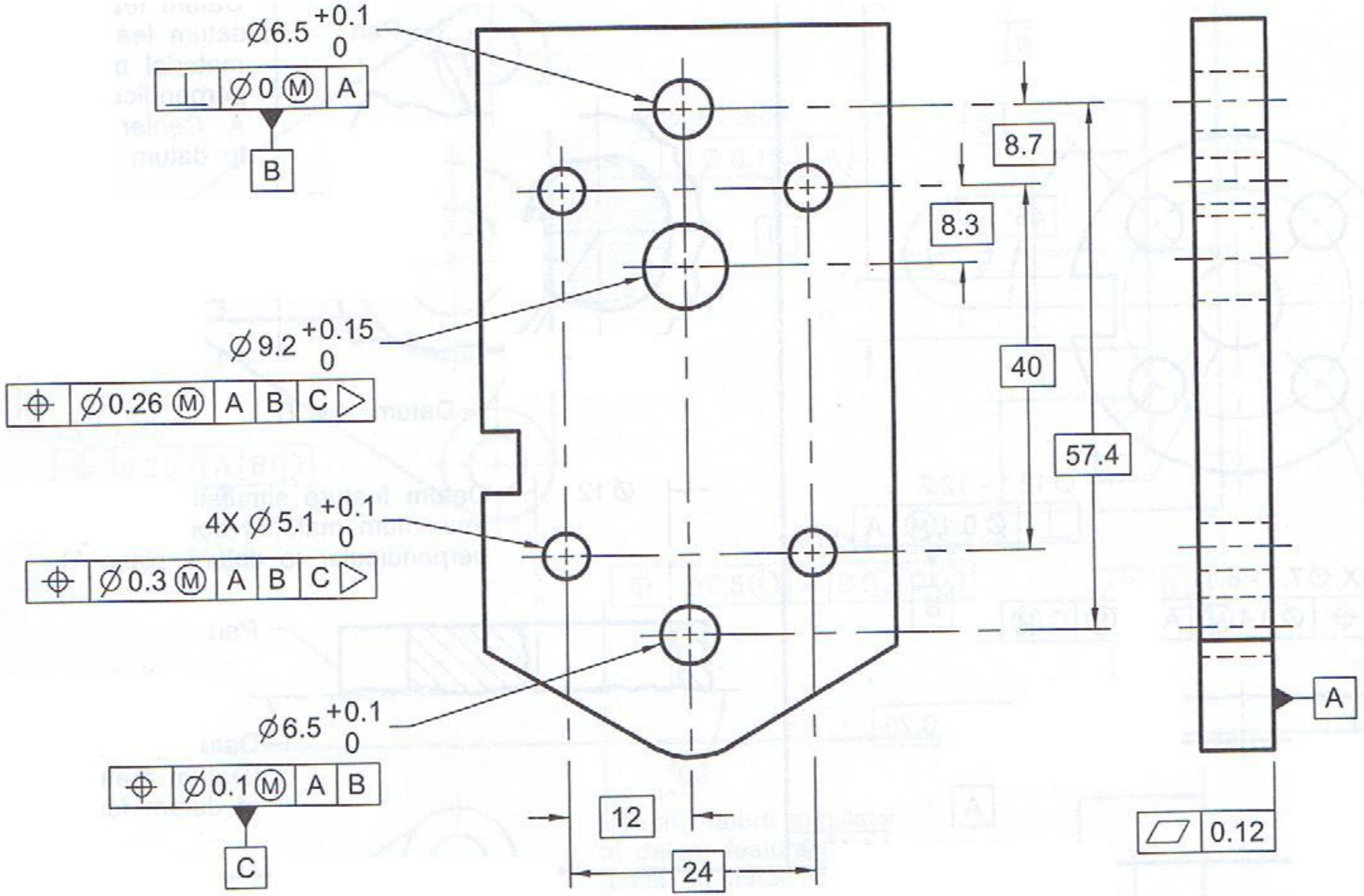


Symbol of Life

- *Figure 3-11 Adds the following new symbols:*
  - *Datum Translation*
  - *Unequally Disposed Profile*
  - *Independency*

Movin' Out

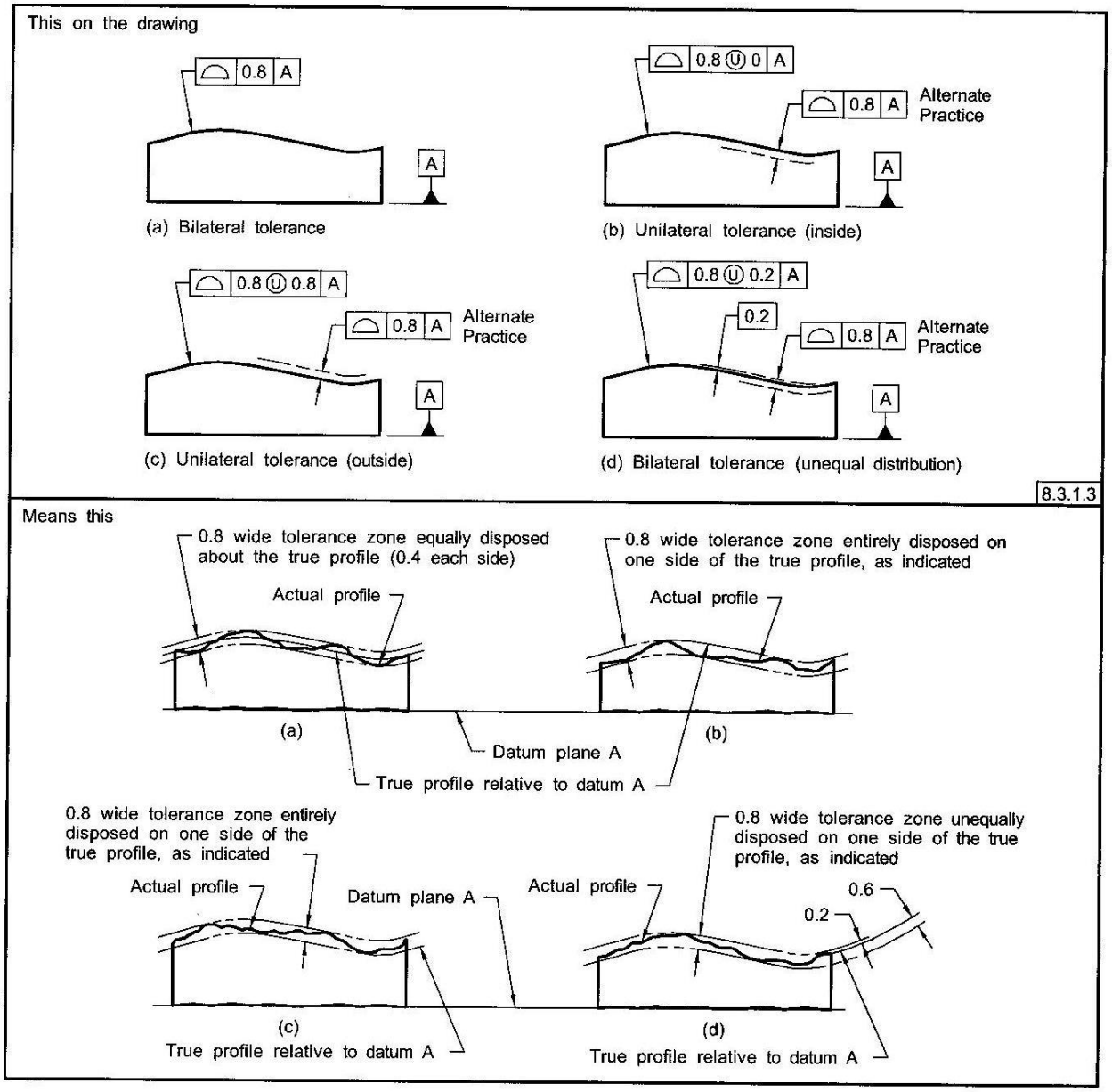
- *New Datum Translation Symbol is a triangle on its side like a pointer.*
- *This overrides the basic dimension for locating a position of a tolerance zone.*
- *This only makes sense if you have a couple of geometric tolerances on a single feature and you want one of the datum callouts to move with the limits if the tolerance and one of the datum callouts need to be absolute in space.*



No Equal

- *New Unequally Disposed Profile Symbol is a "U" in a circle.*
- *This concept has always been in the standard but required you use chain lines and basic dimensions to determine the distribution of a profile tolerance zone other than 50%-50% (practice still allowed).*
- *In the feature control frame you add the symbol and the value of how much material you want to add.*
  - *0.5 (U) 0.5 means it is all added*
  - *0.5 (U) 0 means it can only remove material*
  - *0.5 (U) 0.1 means it can be 0.1 added material and no more than 0.4 removed.*

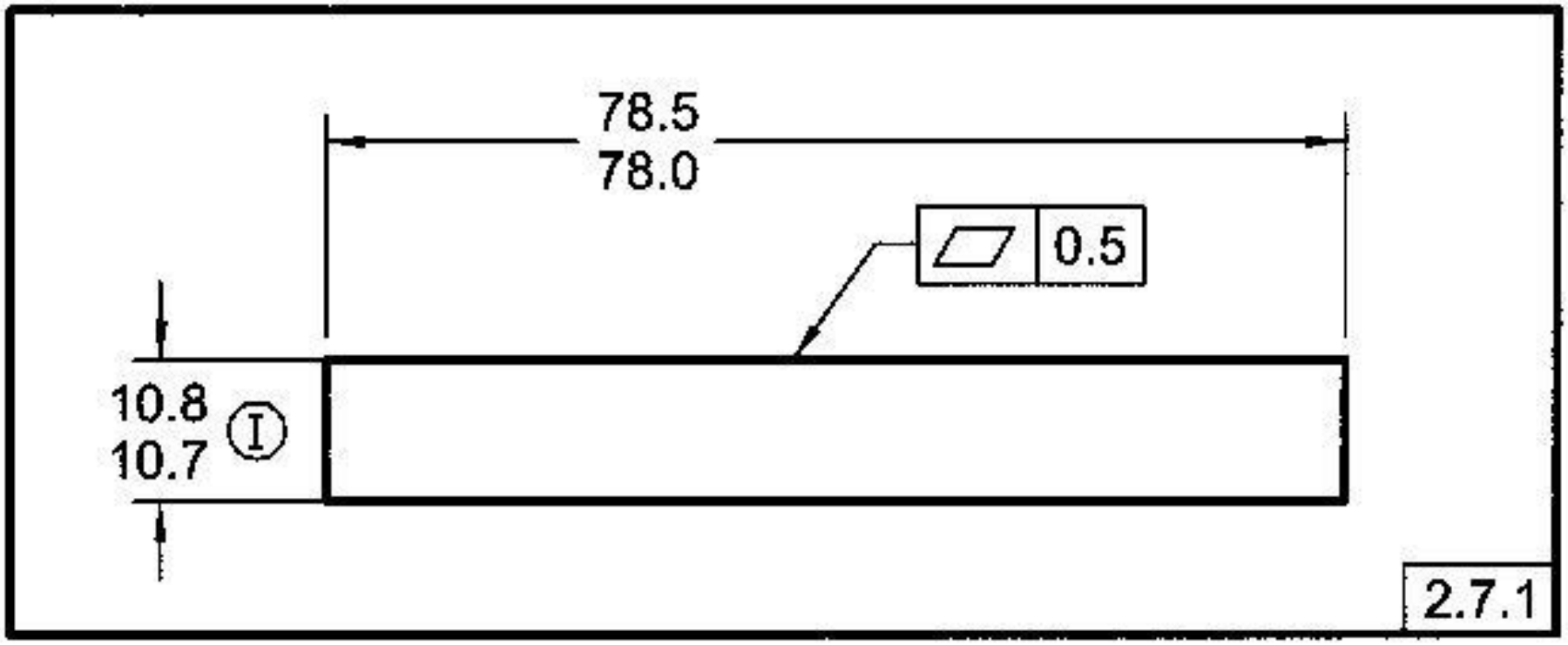
Fig. 8-4 Application of Profile of a Surface Tolerance to a Basic Contour



Independent

- *New Independency Symbol is an “”I” in a circle.*
- *Previous standard required you write out “Perfect Form at MMC (or LMC) is not required.”*
- *Example: If you say a shaft is toleranced at MMC then it must be straight but size may be all that is important to you so you can*
- *This choice of symbol and wording baffles me – If would have gone Old School Ghostbusters and made a circular no symbol with a slash through it and “PF” inside.*

Fig. 2-7 Independency and Flatness Application

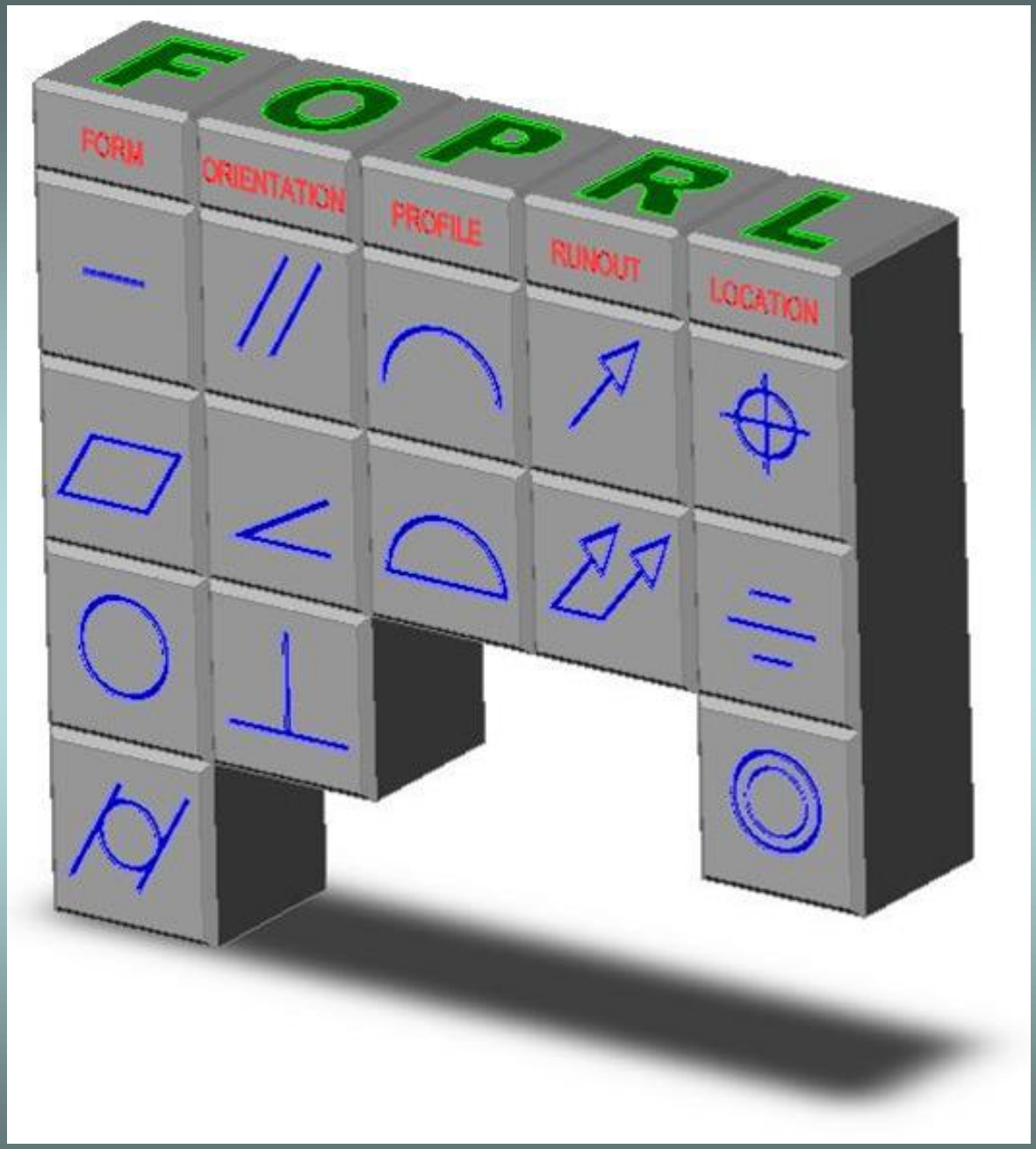


Back To Basics

- *Basic dimensions have always had two methods of identification*
  - *Put a rectangular box around them*
  - *Put a note that says untoleranced dimensions are basic*
- *Basic dimensions can now be identified in "digital data file" (explicitly stated for the first time)*

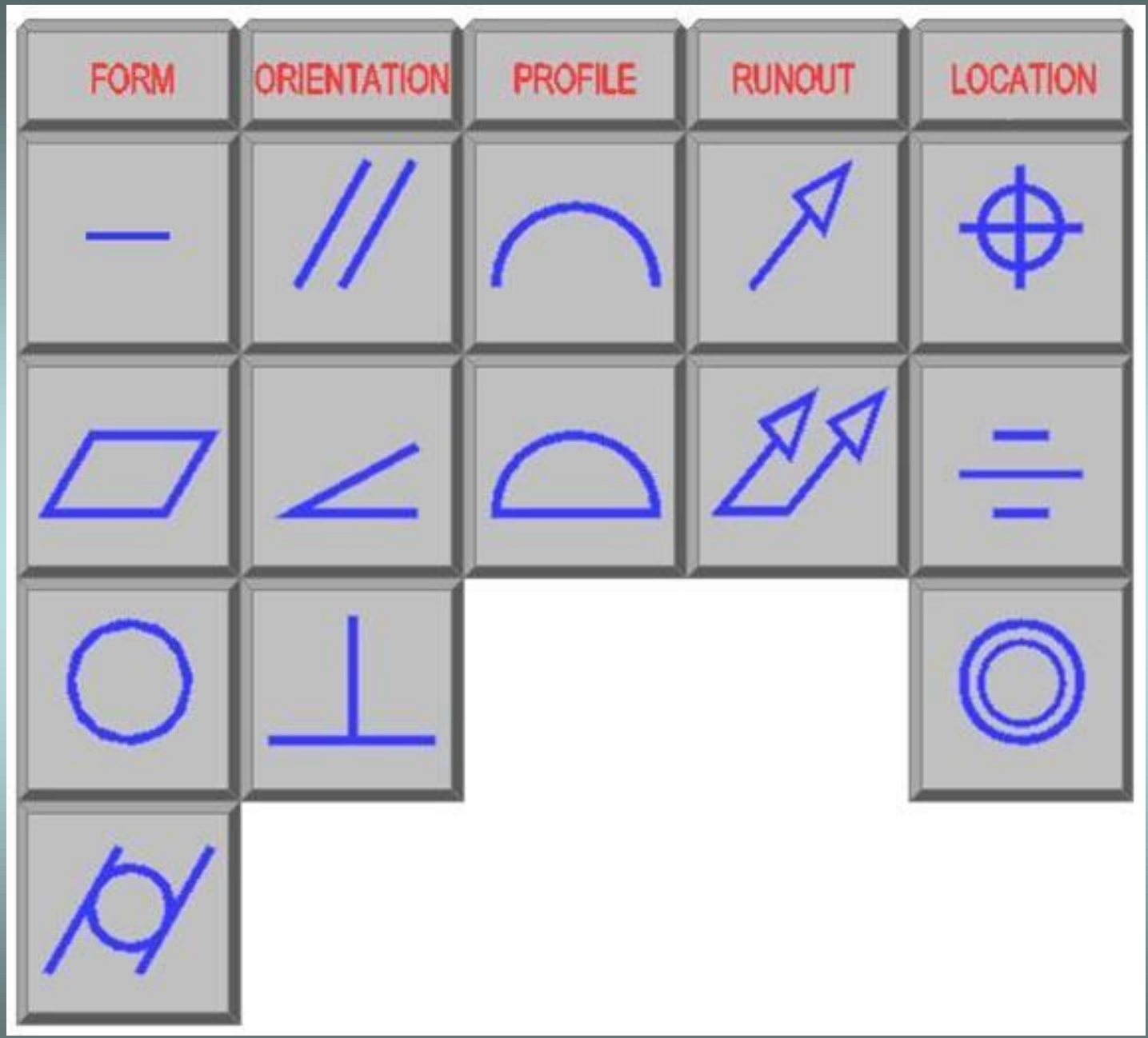
F.I.N.E.

- *For those who have had the pleasure of sitting through my eight hour GD&T Primer seminar or my shorter "How to Spell GD&T" and for those even luckier ones who have managed to avoid it, there's something called a FOPRL chart.*
- *The Form-Orientation-Profile-Runout-Location chart is my own invention and proposes a method of learning GD&T based on a different order than the old (or new) ASME GD&T standard.*


FOPRL
FORM
ORIENTATION
PROFILE
RUNOUT
LOCATION

Beauty Through Order

- *New Order:*
  - *Form, Orientation, Location, Profile, Runout*
- *FOLPR is getting closer to FOPRL....*
  - *It still nice to see the "easier" concepts of form and orientation starting off but with location being such a big oddity I would still make it last but the standard isn't supposed to be a learning tool.*
  - *Plus it keeps people like me giving seminars.*


FORM
ORIENTATION
PROFILE
RUNOUT
LOCATION

Dude Looks Like a Lady

- *What's New with Form*
- *Not a lot of new information here but it is now a separate chapter with lots of examples.*

I Kissed a Girl

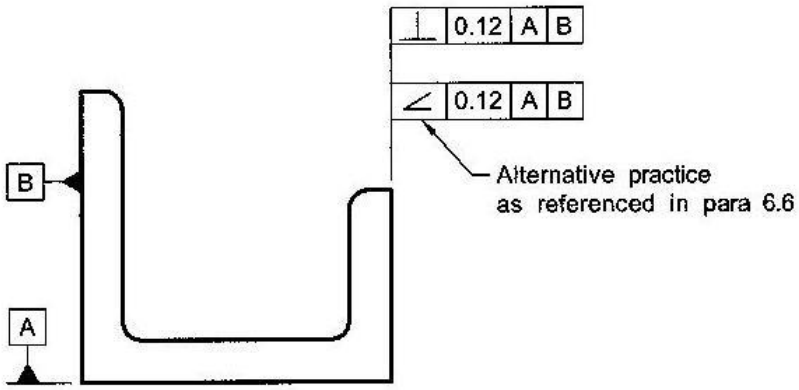
- *What's New with Orientation*
- *Not a lot of new information here but it is now a separate chapter with examples*
  - *I think I've heard that song before.*

Up Against the Wall, Redneck Mother

- *I wish I could more accurately report this one and I've already sent a note to the committee to help explain this one better.*
- *You can "now" use angularity to control perpendicularity if you use two perpendicular datum planes that they now call "alternative practice"*
  - *I don't understand the need, benefit, or anything for this.*

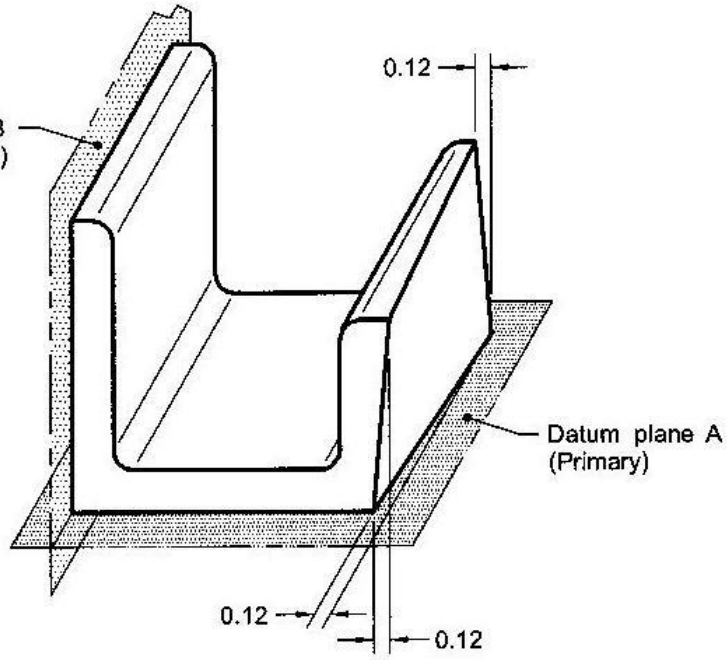
Fig. 6-4 Specifying Orientation for a Plane Surface Relative to Two Datums

This on the drawing



6.6
6.4.2
6.4

Means this



The surface must be between two parallel planes 0.12 apart which are perpendicular to datum plane A. Datum feature B is invoked to constrain an additional rotational degree of freedom of the datum reference frame.

Everything In Its Right Place

- *What's New with Location*
- *The chapter is much, much, much longer with lots more examples.*
- *Whole new section about coaxial features and lists differentiators for coaxial, runout, and concentricity - one of the most confusing tolerances “around”.*
  - *Sorry for the bad pun.*

The Right Profile

- *What's New with Profile*
- *We have always been able to place a circle around the jog of a callout to change it to the "All Around" requirement without the note.*
  - *This means it only applies to the surfaces in the view called out.*
- *We can now place a double circle around the jog of a callout to change it to "All Over" requirement.*
  - *This means it apples to all the surfaces of the part.*
  - *Can not be placed on an isometric projection – not sure why.*
- *Profiles can now be datum features and can be modified with material modifiers.*

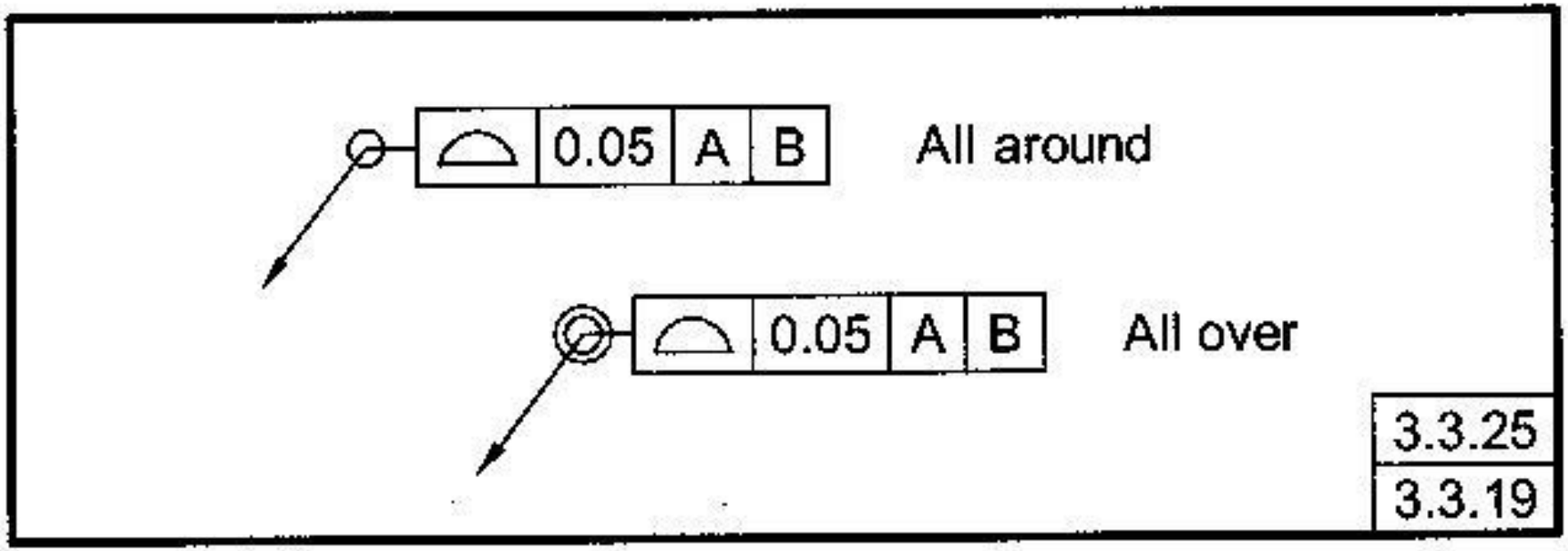
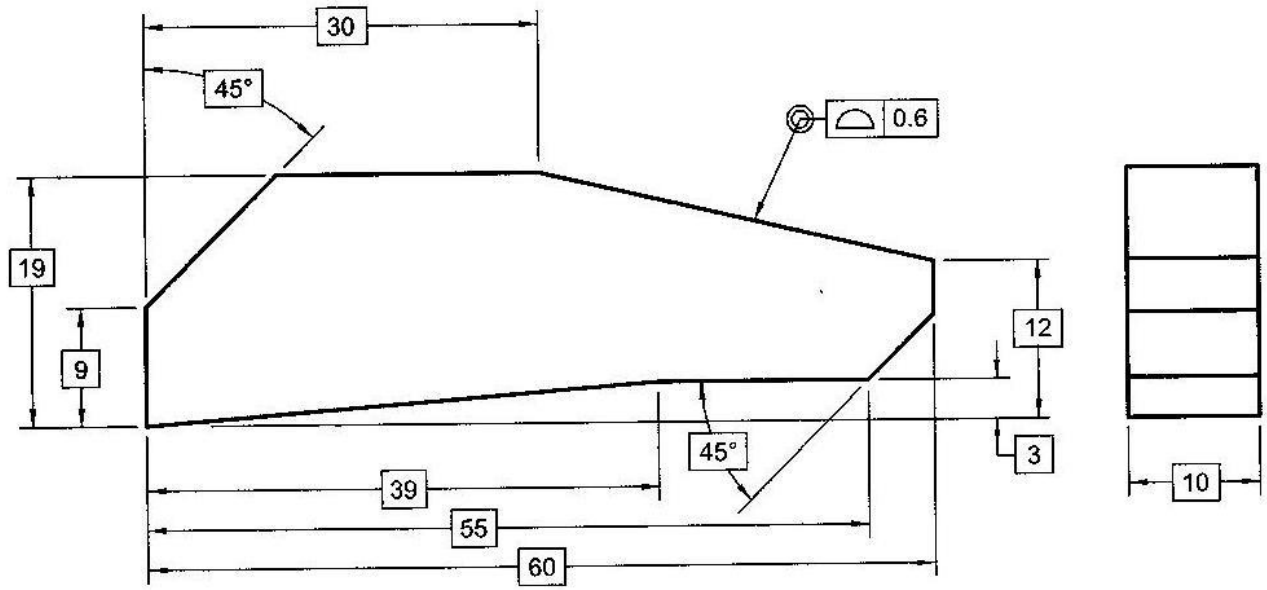


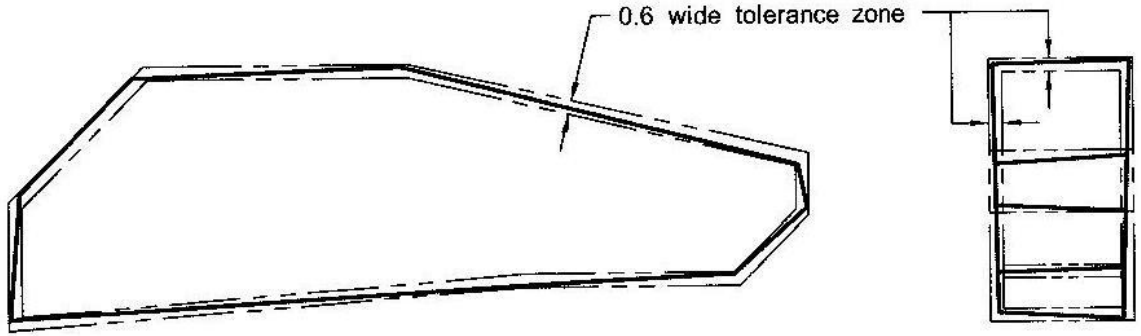
Fig. 8-8 Specifying Profile of a Surface All Over

This on the drawing



8.3.1.6
8.2.1.1
3.3.25

Means this



The surfaces, all over the part outline, must lie between two parallel boundaries 0.6 apart and equally disposed about the true profile.

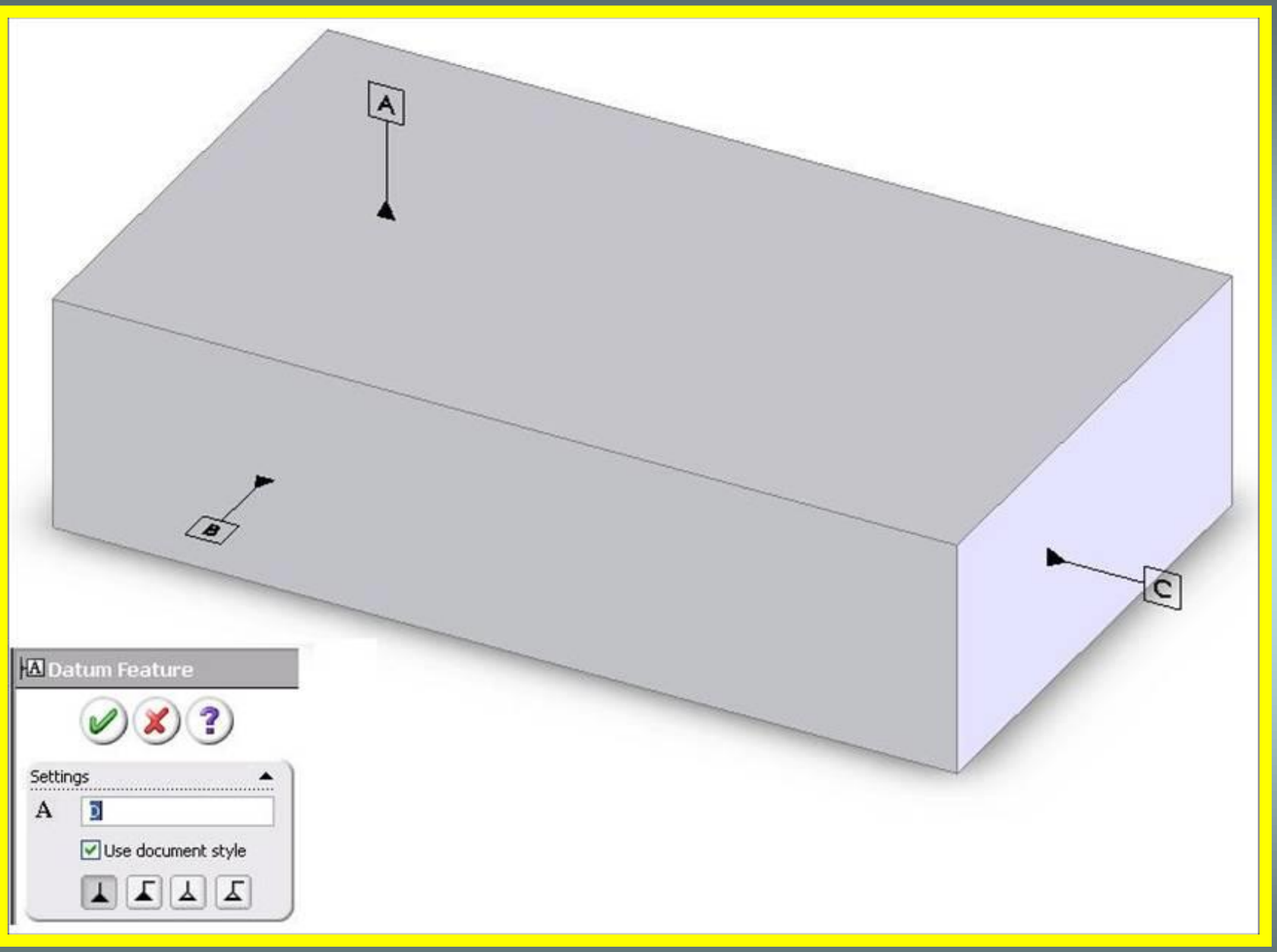
Wheel in the Sky

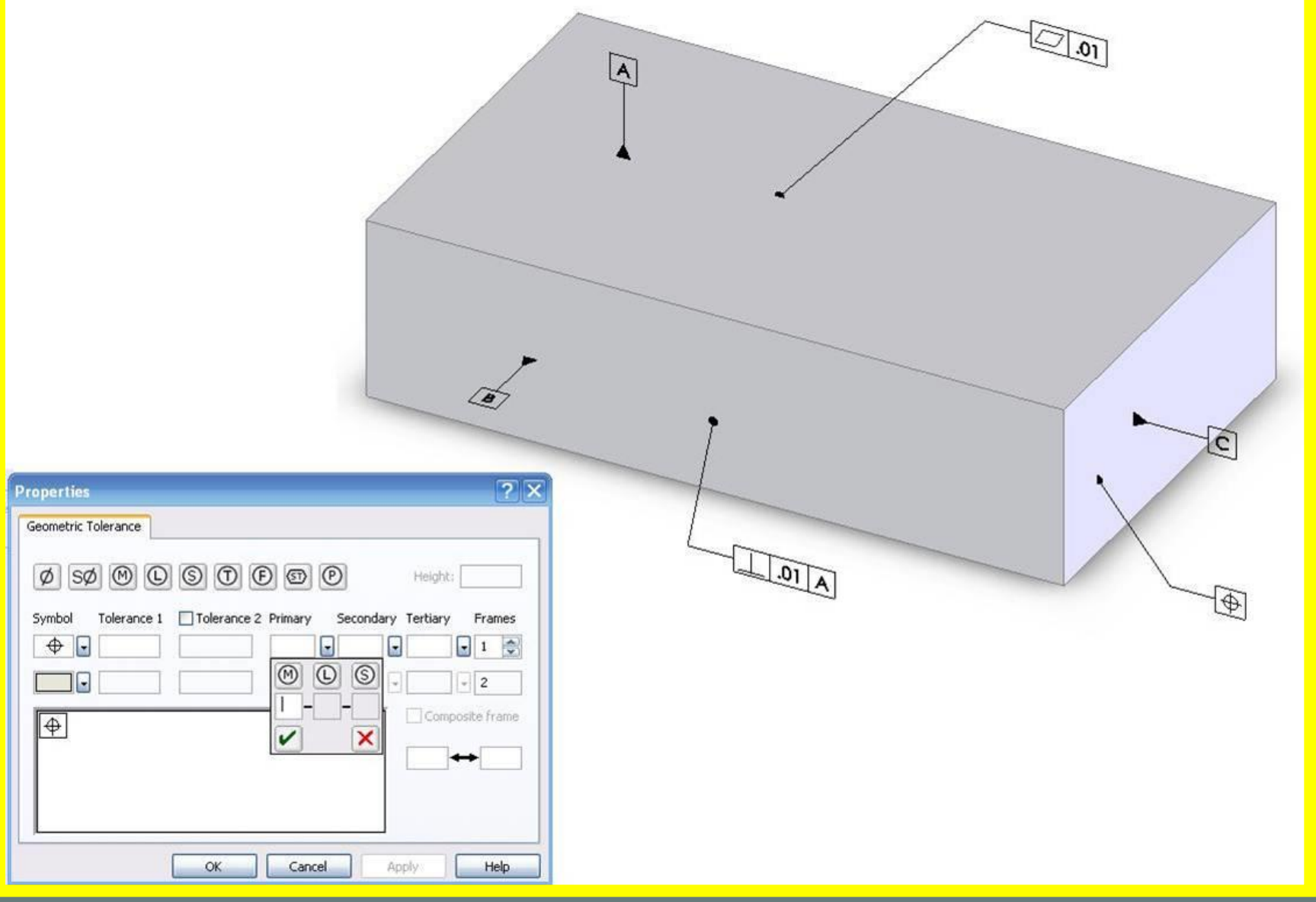
- *What's New with Runout.*
- *Not a lot of new information here but it is now a separate chapter with examples.*

The Best of Times

- *SolidWorks 2009*
- *SolidWorks 2010*
  - *Release before standard updated.*
  - *I'm still waiting on my DVD.*
  - *We're going to need a new font…*

http://www.hlbtech.com/first.html


A
B
C
Datum Feature
Settings
A
D
Use document style



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One is the Loneliest Number

- *Drop Annotation Notes into Dimensions*
- *It is now possible to drag an annotation note and drop it onto a dimension, to become apart of that dimension callout.*
  - *First, LMB click and hold on the annotation note.*
  - *Then, simply drag that annotation note on top of the dimension.*
- *The result is that the text from the annotation note is now included within the text of the dimension.*
- *One limitation is that the dimension field still does not support borders around selected text.*

Party For Two

- *Attach Annotations to Dimensions*
- *Other types of annotation that can be attached to dimensions include GD&T feature control frames, datum feature symbols and surface finish symbols.*
- *Annotations and their leaders may now be attached directly to extension lines.*
- *GD&T annotations now may be dropped right into a dimension callout and then detached with the use of the handles in the upper left corner.*
  - *You can drag geometric tolerances to attach to dimensions – a small "move" dot appears at the top left to detach the geometric tolerance from the dimension.*
  - *This dot was always there just not visible until recently.*
- *Annotations may now be moved around extension lines, and more easily moved from one attachment to another.*

Knock Three Times

- *If you select the top, bottom, left or right edges of the Feature Control Frame and create a datum then that's where the datum will attach.*

Four in the Morning

- *Quantity can now be displayed in many styles around the balloon instead of just the lower value of a split circle.*
- *A gentle reminder that ASME Y14.5M-2009 requires you use 3X convention and not PL, X3, or other number of place symbols or words.*

California Dreamin’

- *If you got anything out of today's discussion:*
  - *You can search the SolidWorks World 2009 notes for "How to Spell GD&T" for a primer to GD&T – Author unknown but it is a spectacular presentation*
  - *You can also come to SolidWorks World 2010 in Anaheim to see the sequel "How to Spell GD&T Part II: The Revenge of the Circled Letters" – same unknown phenomenal author*
- *By all means, hire me to come train your company in GD&T!!!*

Reprise

American Soldier - Toby Keith

Back To Basics - Christina Aguilera

Beauty Through Order – Slayer

Big ‘Ol Truck - Toby Keith

California Dreamin’ – The Mamas & Papas

Changes – David Bowie

Cover Me – Bruce Springsteen

Dance with the One who Brought You - Shania Twain

Danke Schoen – Wayne Newton

Don't Ask Me No Questions - Lynyrd Skynyrd

Dude Looks Like a Lady – Aerosmith

Everything In Its Right Place – Radiohead

F.I.N.E. – Aerosmith

Four in the Morning – Night Ranger

I Kissed a Girl – Katy Perry

I Walk The Line – Johnny Cash

Independent – Webbie

Knock Three Times – Tony Orlando and Dawn

Love is a Bore- Barbara Streisand

Material Girl – Madonna

Movin’ Out – Billy Joel

No Equal – Beatnuts

Old Flame – Alabama

One is the Loneliest Number – Three Dog Night

Party For Two – Shania Twain

Remember The Good Times – Willie Nelson

Save Me – Queen

Shapes of Things – Yardbirds

Symbol of Life – Paradise Lost

Take Me To the Pilot Of This Song – Elton John

The Best of Times - Styx

The Continuous Life – 311

The Right Profile – The Clash

This Song Has No TItle - Elton John

Up Against the Wall, Redneck Mother - Jerry Jeff Walker

What a Long Strange Trip It’s Been – Grateful Dead

Wheel in The Sky – Journey

Who Needs Pictures? – Brad Paisley

Don't Ask Me No Questions

- *GD&T?*
- *SolidWorks?*
- *SolidWorks World?*

American Soldier

- In the 11th hour of the 11th day of the 11th month of 1918, World War 1 ended.
- Since 1919, tomorrow has also been known as Armistice Day or Remembrance Day or now Veterans Day.
- Please let us remember every man and woman who have ever put on a United States uniform and reminded us that Freedom isn't Free.

Danke Schoen

- *Thomas Allsup*
- *www.anidatech.com/SWTechGDT.ppt*