

ARTS3091

5Xj UbWX A YX]U =ggi Yg

GYa YghYf'CbY''##'&\$%

7ci fgY 8YW] g

7 fYX]hDc]bhg**

Giaa UfmcZh\Y 7ci fgY

Gi VYWh5fYU. A YX]Už7i hi fY UbX HYW bc`c[mB Yk a YX]U hYW bc`c[]Yg W U `Yb[Ya UbmcZh Y []j Ybg`cZ W `hi fU `UbX gc W]U `dfUW]W g "5 hih Y gUa Y h]a YžbYk W `hi fU `UbX gc W]U `i gYg cZa YX]U W U `Yb[Ya i W hfUX]h]cbU `h]b_]b[`UVci ha YX]U 'hVci 'k]``Yl d`cfY h Y bUhi fY cZ]bWYUg]b[`mXmbUa]Wa YX]U hYW bc`c[]Ygž UbX h Y bYk 'W `hi fU `UbX gc W]U `dfUW]W g U `cb[g]XY k \]W `a YX]U hYW bc`c[]Yg Yj c`j Y " Mci 'k]`` Wcbg]XYf _YmWcbhYa dcfUfm]XYUg UVci ha YX]UžW `hi fU `UbX gc W]U `W Ub[Y "Ghi XYbhg k]`` i bXYfhU_Y [i]XYX UbX gY ZX]fYWhYX fYgYUfW "Hcd]Wg Yl Ua]bYX Wci `X]bWi XY. X][]HU `UbX bYhk cf_YX a YX]U `cZ U `` _]bXg/]a a Yfg]j Yž]bhYfUW]j Y cf`Ui [a YbhYX a YX]U "fYU`]hJYg"/XUhU g\Uf]b[/h Y]a dUWhcZa YX]U hY W bc`c[mhU_Y i d`]b _YmW `hi fU `UbX gc W]U `dfUWf]W gž ZcfYl Ua d`Y \YU`h žYXi Wbhcž UfhUbX XYg][bž[cj Yfba YbhžbYk

5ggYgga Ybh

 $\hbox{D'YUgY'gYY'h} \hbox{A'Y'Wc} \hbox{i fgY'A ccX'Y'g} \hbox{hY'Zcf'a cfY'XYhU} \hbox{]`g''}$

5ggYgga Ybh'HUg_g'

5ggYgga Ybh'hUg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[CihWca Yg 5ggYggYX
:]bU``9ggUm[]j]b['Ub 5VWci bhcZmci f'F YgYUfVX 9I d`cfUh]cbg') \$1	\$, #\$*#&\$% `\$).\$\$`DA	%ž&ž ž(ž) ž* ž+
F YgYUfWW. "Dffcctdcjglu"	&) ı	&*#\$(#&\$% `\$).\$\$`DA	%ž&Ž ž(ž) ž*
DYfgcbU`'7 ci fgY'5fWk]j Y'UbX FYZYW¶cbg'	&) ı	Bch5dd`]WUV`Y	%ž&Ž Ž(Ž+

5ggYgga Ybh8YHJ]`g

 $5\,ggYgga\ Ybh\%:\]bU``9ggUm[\]j\]b[\ `Ub`5WWci\ bhcZmci\ f`FYgYUfWX``9I\ d`cfUh]cbg$

GhUfhXUhY. Bch5dd`]WUV`Y

Gi Va]gg]cb bchYg.bi ``

5ggYgga Ybh' . 'D

bX h''. D

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Gh XYbhg UfY Yl dYWYX hc di hh\Y]f bUa Yg UbX gh XYbhbi a VYfg cb Yj YfmdU[Y cZh\Y]f Ugg][ba Ybhg"

Hi fb]h]b Gi Va]gg]cb

#mci YbWci bhYf'U'dfcV'Ya 'k \Yb'UthYa dr]b['rc'gi Va]hmci f'Ugg][ba Ybht\fci [\'Hi fb]r]bž'd'YUgY
hY'Yd\cbY'9I hYfbU'Gi ddcfhcb'-',) '''' %cf'Ya U]''h\Ya 'cb'<u>Yl hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui"</u>"'Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY_YbXg'fl *) 'XUmg'U'mYUft\"'=\maintention
UfY'i bUV'Y'hc'gi Va]hmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\'Hi fb]h]b'mci 'a Um'Udd'm\Zcf'Ub'YI hYbg]cb\ZVi hmci
a i ghfYhJ]b'mci f'h]\W_Yhbi a VYf\Zfca '9I hYfbU''Gi ddcfhfU'cb['k]h\'Ubmch\Yf'fY'Yj UbhXcW'a Ybhgt'hc
]bWi XY'Ug'Yj]XYbW' hc'gi ddcfhmci f'Yl hYbg]cb'Udd']\WJh]cb'''\=\maintention
Uh\WJ'`mfYWY']j Y'U'h]\W_Yhbi a VYf\ZVi h]Zmci 'hY'Yd\cbY'mci 'k]``bYYX'hc'gdYW]\Z\WJ'`mUg_'Zcf'cbY''
Hi fb]h]b'U'gc'dfcj]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'gfUh' g'cb'Hk]hYf"

; YbYfU`mž'UggYgga YbhitUg_g'a i ghiVY'gi Va]lth/X'Y`YWfcb]WU`mj]U'Y]th\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh''=b']bgtUbW'g'k \YfY'th\]g']g'bchdcgg]V`Yž']hk]```VY'gtUhYX'cb'mci f'Wci fgY'g'A ccX`Y'g]hY'k]th\U`hYfbUh]j Y'gi Va]gg]cb'XYhU]`g''

@UhY 5ggYgga Ybh'DYbU`h]Yg

5b'UggYggYX'HJg_']g'XYYa YX``UhY']Z]h']g'gi Va]hhYX'UZhYf'h\Y'gdYW]Z]YX'h]a Y'UbX'XUhY'Ug'gYhci h']b'h\Y Wti fgY'@YUfb]b['A UbU[Ya YbhGmghYa 'f@A GŁ"

K cf_'gi Va]hhYX'Zci fhYYb'fl%(Ł'XUmg'UZhYf'h\Y'Xi Y'XUhY'k]``VY'a Uf_YX'UbX'ZYYXVUW_'dfcj]XYX'Vi hbc'a Uf_ k]``VY'fYWcfXYX"' ₹h\Y'k cf_'k ci `X'\Uj Y'fYWr]j YX'U'dUgg'a Uf_'Vi hZcf'h\Y``UhYbYgg'UbX'h\Y'k cf_']g'U Wca di `gcfm'Wci fgY'Wca dcbYbhz'U'gh XYbh'k]``VY'XYYa YX'hc'\Uj Y'a Yhih\UhfYei]fYa Ybh''H\]g'XcYg'bch Udd`mhc'U'hUg_'h\Uh']g'UggYggYX'Vi h'bc'a Uf_']g'Uk UfXYX"

K cf_'gi Va]hh/X'hk YbhnlcbY'f&&XUmg'UZhYf'h\Y'Xi Y'XUhY'k]``'bchVY'UWWdhYX'Zcf'a Uf_]b['cf'ZYYXVUW_UbX'k]``'fYWY']j Y'bc'a Uf_'cf'[fUXY"'=Zh\Y'UggYgga YbhHUg_']g'U'Wca di `gcfmWca dcbYbhcZh\Y'Wci fgY'U ghi XYbhk]``'Ui hca UhJWU``mZJ]`'h\Y'Wci fgY"

GdYWJU`7cbg]XYfUhJcb55dd`]WUhJcbg

 $\label{eq:linear_continuity} $$Mc_i = W_0 - W_$

G]W_bYggža]gUXj Ybhi fY'cf'ch\Yf'W]fW a ghUbWrg'VYmcbX'mci f'Wcbhfc``a Um

ł DfYj Ybhimci Zfca Wca d`Yhlb[U.Wci fqY fYei]fYa Ybhž

ł? YYd mci Zfca 'UthYbX]b['Ub 'UggYggUV'Y 'UWnji]tmž

ł Ghod moi gi Va]hh]b['UggYggUV'Y k cf_ Zcf'U Wci fgYž

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga `]g`i g]b['h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b['h\Ya `Ug`mci f`ck b"'\lefi\Wb'hU_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b['hc`UVW]XYbhU`mWcdm]b['Zfca `U`gci f\W' k]h\ci hUW_bck `YX[Ya Ybh'

IBGK [fcidgdu[]uf]ga]bhch\YZc``ck]b[WuhY[cf]Yg.

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'j Yfmg]a]`Uf'k cfXg'hc'h\Y'cf][]bU`hYl h'cf']XYU'k]h\ci h'UW_bck `YX[]b['h\Y gci fW'cf'i g]b['ei chUh]cb'a Uf_g"'H\]g'U`gc'Udd`]Yg'hc']a U[Ygž'Ufh'UbX'XYg][b'dfcYWhgž'Ug'k Y``'Ug dfYgYbhUh]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch\Yf'g']XYUg'cf'k cfXg'k]h\ci h'WfYX]h'

±DUddfcdf]UhY`dUfUd\fUg]b[.'W\Ub[]b['U'ZYk'kcfXg'UbX'd\fUgYg'k\]`Y`acghmfYhJ]b]b['h\Y`cf][]bU`ghfi WhifY`UbX`]bZcfaUh]cb`k]h\ci hUW_bck`YX[YaYbh'H\]g'U`gc'Udd`]Yg`]b'dfYgYbhUh]cbg'k\YfY`gcaYcbYdUfUd\fUgYg`Ubch\Yf'g`]XYUg`cf'kcfXg'k]h\ci hWfYX]h''±iU`gc'Udd`]Yg`hc'd]YW]b['hc[Yh\Yf'ei chYg'UbXdUfUd\fUgYg`]bhc'U'bYk'k\c`Yžk]h\ci hfYZ/fYbW]b['UbX'U'ghi XYbh'g`ck b'UbU`mg]g`hc'Vf]b['h\Y`aUhYf]U`hc[Yh\Yf''

7 c``i g]cb. 'k cf_]b['k]h\ 'ch\ Yfg'Vi h'dUgg]b['c\Z'h\ Y 'k cf_'Ug'U'dYfgcb'g']b\X]j]\Xi U``k cf_"'7 c``i g]cb'U`gc]b\Wi XYg'dfcj]\X]b['mci f'k cf_'hc'Ubch\ Yf'ghi XYbh\ VYZcfY'h\ Y 'Xi Y 'XUhYzcf'Zcf'h\ Y' di fdcgY'cZh\ Ya d`U[]\Uf]g]b['Uh\Ubmh]a Yz'dUm]b['Ubch\ Yf'dYfgcb'hc'dYfZcfa 'Ub'U\WUXYa]\Wh\Ug_z'ghYU']b['cf'U\\ello i]f]b[Ubch\ Yf'dYfgcb'g' U\WUXYa]\Wk cf_'Ub\X'\\ello dm]b[']hz'c\ZYf]b['hc'\\ello a d`YhY'Ubch\ Yf'dYfgcb'g' k cf_'cf'gYY_]b[d\una Ybh\Zcf'\\ello a d`Yh\beta d`

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[ˈgci fW/gˈk \]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW_bck`YX[]b[ˈh\Y`″gYWcbXUfm″gci fW/Zfca k \]WX`_bck`YX[Y`cZh\Ya`\Ug'VYYb`cVhU]bYX"

8 i d`]\WUh]cb`ff`gY`Zld`U[]\Uf]ga "Ł`gi Va]\h]b[`mci f`ck b`k cf_ž]b`k \c`Y`cf`]b`dUfhžk \YfY`]h`\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\hYX`Zcf`Ubch\Yf`UqqYqqa Ybhcf\Wci fgY`UhI_BGK_`cf`Ubch\Yf`i b]\Yfq]\m"

7 cffYWhfYZYfYbWb[dfUWhWyg.

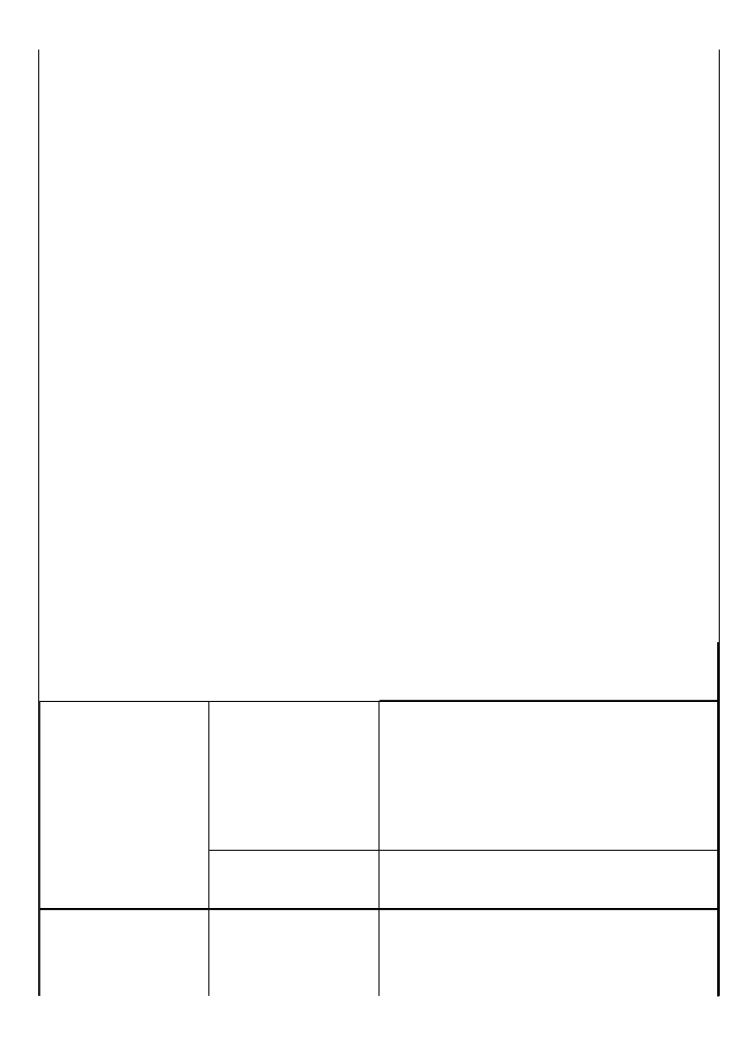
• VYHYfa UbU[Ymcifh]a Y

7ci fgY GWXYXi `Y

J]Yk 'WUgg'ha YHUV'Y

H]a YtUV`Y

8 UHY	HmdY	7cbhYbh
K YY_'%'&*': YVfi Ufm!'(A UfWX	@YWhi fY	KYY_CbY ±ohfcXiWh]cb AYX]UžGcW]U`UbX 7i`hifU`7∖Ub[Y
		H\YfY`Z]fgh`YWnfY`k]``VY`]b`h\Y`YWnfY`h\YUffY" H\YfY`k]``U`gc`VY`U`fYWcfX]b[`jYfg]cb`cb`]bYžk]h\`U dXZcZh\Y`dckYfdc]bh'`8da_ iWN]\$IfZWdWi[^TW `a WUfgdWe[`fZW`WUfgdWfZWSfdW
		: fca 'k YY_g'&!% '`YWi fYg'k]``VY'fYWtX]b[g'UbXch\Yf'a UhYf]U'g'cb`]bYž']b'"Z]ddYX'WUggfcca "'a cXY"Mci 'UfY'fYei]fYX'nc'Yb[U[Y'k]h\'U``cZh\Y'`YWi fYa UhYf]U``cb`]bY'VYZcfY'h\Y'fY`Yj Ubhih ncf]U'g'h\UhYb[U[Y'k]h\'h\Y'`YWi fY'hcd]Wg"
		#i]g YggYbh]U`h\Uhmci [chch\YWci fgYAccXYg]hYZcfacfYXYhU]`g ZcfYUW\k YY_"8cbchfY`mcbh\]g j Yfg]cb7ci fgYCi h]bY"#i]g ^ ghU'VUfYci h]bY"Mci WUbi gYh\]g ci h]bY'k\Yb]hWcaYghcGW\cc#UW`h]Yg'dc`]W]YgžZcfYl Uad`Ycb``UhYbYggcfYl hYbg]cbgfY[UfX]b['Ugg][baYbhg"
	Hi hcf]U`	Bc'hi hcf]U`g'h\]g'k YY_"'Hi hcf]U`g'VY[]b']b'K YY_ Hkc"
K YY_'&.') 'A UfW\'!'%% A UfW\	@YWn fY	K YY_`Hk c A YX]Už`GcW]U``UbX`7i`hifU` 7\Ub[Y H\Y`H\]fX`A YX]U FYjc`ih]cb H\]b_]b[`k]h\`≢ž`K cf_]b[`k]h\`≢n
		GYY`WtifgY`AccX`Y`g]hY`Zcf`acfY`XYhJ]`g`UbX`Zcf `]b_g`UbX`fYWtfX]b[g`cZh\Y``YWfifYg"
	Hi hcf]U`	Hi hcf]U`g`VY[]b`h\]g`k YY_"`GYY`Wci fgY`A ccX`Y`g]hY Zcf`a cfY`XYhJ]`gž`]bWi X]b[`fYUX]b[gž`]b_g`UbX UWhJj]h]Yg"
K YY_'' .''‰'A UfW\'!'% A UfW\	@YWhi fY	K YY_`H\fYY H\Y`7fYUh]cb`cZK cf`Xg :]Y`Xgž K cf`Xg`UbX`A YX]U`UbX`7ca a i b]WUh]cbg
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`XYhU]`gžfYWcfX]b[g`UbX `]b_g"
	Hi hcf]U`	GYY`Wci fgY`A ccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX UWfj]h]Yg"
K YY_"(."%-"A UfWX"!"&) A UfWX	@YWn fY	KYY_:cif AYX]Už7caaib]WUh]cbg'UbX':`ckg
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`XYhU]`gžfYWcfX]b[g`UbX `]b_g"
	Hi hcf]U`	GYY`Wci fgY`A ccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX



		`]b_g"
	Hi hcf]U`	•
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX UWfj]]h]Yg"
K YY_'%\$.'+'A Um!'% A Um	@YWhi fY	K YY_'9`Yj Yb H\]fX'A YX]U'F Yj c`i h]cb']b'5Wh]cb (.'BYhk cf_gž7\Ub[]b['7ca a i b]h]Yg'UbX 9Wcbca]Yg
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`XYhJ]`gž`fYWcfX]b[g`UbX `]b_g"
	Hi hcf]U`	GYY`Wci fgY`A ccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX UWnjj]h]Yg"
K YY_'%%'%('A Um'!'&\$ A Um	@YWhi fY	K YY_'Hk Y`j Y H\]fX`A YX]U`F Yj c`i h]cb`]b`5Wh]cb). '8UhU`Ug`h\Y`DchYbh]U``Zcf': YY`]b[. 'F YU` 9j YbhgžA UhYf]U``K cf`Xg`UbX`7 ca a i b]WUh]cb. 9WcUYgh\Yh]Wg`UbX`h\Y`8][]hU``8cW a YbhUfm
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`XYhU]`gž`fYWcfX]b[g`UbX `]b_g"
	Hi hcf]U`	GYY`WcifgY`AccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX UWhjj]hjYg"
K YY_"%&."&%A Um!"&+ A Um	@YWhi fY	K YY_`H\]fhYYb A YX]Už7ca a i b]WUh]cbg`UbX h\Y`: i hi fY. DcgHA YX]U3`DcgH8][]hU`3
		GYY`WcifgY`AccX`Y`g]hY`Zcf`XYhU]`gžfYWcfX]b[g`UbX `]b_g"
	Hi hcf]U`	•
		GYY`Wci fgY`A ccX`Y`g]hY`Zcf`fYUX]b[gž``]b_g`UbX UWhjj]hjYg"

FYgci fW/g

DfYgWf]VYX F Ygci fWYg

GYY Wci fgY 'A ccX`Y 'g]hY 'Zcf'fYgci fWYg"

FYWca a YbXYX FYgci fW/g

GYY Wci fgY 'A ccX`Y 'g]hY 'Zcf'fYgci fWYg"

7 ci fgY '9j U'i Uh]cb 'UbX '8 Yj Y'cda Ybh

K Y`\UX`YUf`]Yf`fYgdcbXYX`lc`75H9=ZYYXVUW_Zfca `&\$\%\Vm\W\Ub[]b[`lh\Y`Xi fUh]cb`cZ`Y\Wi fYg`UbX hi lcf]U`gžUbX`\WUf]Zm]b[`lh\Y`XYj Y`cda YbhdchYbh]U``cZVch\`gi ghU]bYX`lcd]\WfYgYUf\W``UbX`]bX]j]Xi U``k f]h]b[dfc Y\Wg"`=b`&\$\%+žk Y`\Uj Y`fYgdcbXYX`lc`lh\Y`ei Ygh]cbg`cZ\\cbj Yb]Yb\\Y`]b`U`k Umh\Uhk Y`\cdYX fgi \\W\Y`ggZ\``m=h\]b_Ek ci `X`U``ck `ghi XYbhg`Vch\`ZYI]V]`]\m]bž\UbX`Yb\Ub\\Ya Ybhc\Zi'h\Y]f``YUfb]b[Yl dYf]Yb\\Y\"K Y`X]X`lh\]g`Vm\"Z]dd]b[`lh\Y`\WUggfcca \\Thc\Zi'j\]\g`\g\\Y\f\Zi'j\]g`a YUbg``Y\\f\Ta UhYf]U`g`UfY`cb`]bY\Z \\c\Yj\Yf\Zih\]g`Uhmci f`\\ch\Sj\Yb\\Y\E'`Gca Y`ghi XYbhg`k UbhYX`U`dUfh]\\]dUh]cb`a Uf_Zk\\]\\\`=h\]b_]g`U`[ccX`]XYU" < ck Yj Yf\Zih\]g`]g`bc``cb[Yf`U``ck YX`i b`Ygg'h\YfY`]g`Yl lfU`k cf_UhhU\XYX\Zigi Va]hhYX`UbX`UggYggYX\Zk\]\\