



# ARTS3067

: ]a `Gh X]Yg` ðhYfbg\]d

GYa YghYf`Hk c`#`&\$%



GWcc`cZH Y`5ftg`UbX`A YXJU`#`I BGK `5ftg`UbX`GcWJU`GWYbWg

7 ci fgY`Cj Yfj ]Yk

`GHUZZ`7 cbhUW`i8YHU]`g`

`7 cbj Ybcfg`

B Ua Y	9a U]`	5j U]UV]]m	@cWU]cb	D\cbY
F Ua Ugk Ua ] < Uf]bXfUbuUk	f"\Uf]4 i bgk "YXi "Ui	H\i fgXUmg - "" \$!%\$" \$	&&žF cVYfh K YVghYf Vi ]X]b[	

GWXcc`7 cbhUW`i`bZcfa Uh]cb

F cca " %&ž`Yj Y"" `F cVYfhK YVghYf`6i ]X]b[

D\cbY. fB&Ł-' , ) '( , ) \*

9a U]: [gUa 4 i bgk "YXi "Ui](#)

K YVg]hY: [\hfdg.#gUa "Ufng"i bgk "YXi "Ui](#)

H\Y`GWXcc`cZ`hY`5fng`UbX`A`YX]U`k`ci`X`\_Y`hc`F`YgdYW`m5W`bck`YX[`Y`h`Y`HfUX]h]cbU`7`i`g`hcX]Ubgž`h`Y`6YXY[`U`f`P`Ybg]b[`hc`b`W`a`di`g`Łž;`UX][`U`f`7`]m`UbX`5`f`h`i`8`Yg][`b`7`Ua`di`g`YgŁ`UbX`h`Y`B`[`i`bb`Uk`U`d`Ycd`Y`f`5i`gfU]`Ub`8`Y`Z`b`W`:`cf`W`5`W`U`X`Ya`m]b`7`Ub`V`Y`ff`U`Ł`c`Z`h`Y`U`b`X`g`k`Y`f`Y`U`U`W`W`a`di`g`c`Z`I`B`G`K`]g`c`W`h`Y`X`"

5 hY`bX`Ub`W`F`Yei`]f`Ya`Y`bhg

5`gh`i`XY`bh]g`YI`d`Y`W`X`h`c`U`h`Y`b`X`U`W`U`gg`W`c`b`h`U`W`h`c`i`fg`Z`c`f`U`Z`J`W`!`h`c`!`Z`J`W`f`l`&`Ł`c`f`V`Y`b`X`Y`X`W`c`i`fg`Y`Ub`X`W`c`a`d`Y`h`U`W`U`W`j`]h`Y`g`Z`c`f`U`V`Y`b`X`Y`X`c`f`Z`m`c`b`]b`Y`W`c`i`fg`Y`"

5`gh`i`XY`bhk`c`U`ff]j`Yg`a`c`f`Y`h`Ub`%`a`]b`i`h`Y`g`U`h`a`U`m`V`Y`d`Y`b`U`]g`Y`X`Z`c`f`b`c`b`!`U`h`Y`b`X`Ub`W`"Z`g`i`W`X`U`d`Y`b`U`h`m`]g`]a`d`c`g`Y`X`ž`h`Y`gh`XY`b`h`a`i`gh`V`Y`]b`Z`c`f`a`Y`X`j`Y`f`V`U`m`U`h`h`Y`Y`b`X`c`Z`W`U`gg`U`b`X`U`X`j`]g`Y`X`]b`k`f`h]b[`k`]h`]b`&(`\`c`i`fg`"

Z`U`gh`i`XY`bhYI`d`Y`f`]Y`b`W`g`]`b`Y`gg`ž`a`]g`U`X`j`Y`bh`f`Y`c`f`c`h`Y`f`c`W`W`f`f`Y`b`W`h`U`h`a`U`\_`Y`g`U`V`g`Y`b`W`Z`c`a`U`W`U`gg`#`U`W`j`]m`i`b`U`j`c`]X`U`V`Y`ž`c`f`YI`d`Y`W`g`h`c`V`Y`U`V`g`Y`bh`Z`c`a`U`Z`c`f`h`W`c`a`]b[`W`U`gg`#`U`W`j`]m`ž`h`Y`m`g`l`c`i`X`g`Y`Y`\_`d`Y`f`a`]g`g`]c`b`Z`c`a`h`Y`7`ci`fg`Y`5`i`h`c`f`]m`ž`U`b`X`k`Y`f`Y`U`dd`]W`U`V`Y`ž`h`Y`f`f`Y`ei`Y`gh`g`l`c`i`X`V`Y`U`W`W`c`a`d`U`b`]Y`X`V`m`U`b`c`f`[`]b`U`c`f`W`f`h]Z`Y`X`W`c`d`m`c`Z`U`a`Y`X`]W`U`W`f`h]Z`W`U`h`c`f`c`h`Y`f`Z`c`f`a`c`Z`U`dd`f`c`d`f`]U`h`Y`j`]X`Y`b`W`"

5`7`ci`fg`Y`5`i`h`c`f`]m`a`U`m`YI`W`g`Y`U`gh`i`XY`bh`Z`c`a`W`U`gg`Y`g`c`f`U`W`j`]h`Y`g`Z`c`f`i`d`h`c`b`Y`a`c`b`h`"c`k`Y`j`Y`f`ž`h`Y`m`a`U`m`U`gg][`b`U`X`X`]h]c`b`U`U`b`X`#`c`f`U`h`Y`f`b`U`h]j`Y`h`U`g`\_`g`h`c`Y`b`g`i`f`Y`W`c`a`d`]U`b`W`"5`7`ci`fg`Y`5`i`h`c`f`]m`W`c`b`g`]X`Y`f`]b[`h`Y`[`f`U`b`h]b[`c`Z`U`V`g`Y`b`W`a`i`gh`V`Y`g`U`h]g`Z`Y`X`U`gh`i`XY`bhk`]`gh`V`Y`U`V`Y`h`c`a`Y`Y`h`h`Y`W`c`i`fg`Y`g`Y`U`f`b]b[`c`i`h`W`c`a`Y`g`U`b`X`#`f`j`c`i`a`Y`c`Z`Y`U`f`b]b[`"5`gh`i`XY`bh`g`Y`Y`\_]b[`U`dd`f`c`j`U`h`c`V`Y`U`V`g`Y`bh`Z`c`f`a`c`f`Y`h`Ub`c`b`Y`a`c`b`h`a`i`gh`U`dd`m`]b`k`f`h]b[`h`c`h`Y`8`Y`U`b`U`b`X`d`f`c`j`]X`Y`U`c`f`[`]b`U`c`f`W`f`h]Z`Y`X`g`i`d`d`c`f`h]b[`X`c`W`a`Y`b`h`U`h]c`b`"

:`c`f`a`c`f`Y`]b`Z`c`f`a`U`h]c`b`U`V`c`i`h`h`Y`U`h`Y`b`X`Ub`W`d`f`c`h`W`c`g`]b`h`Y`:`U`W`h`m`c`Z`5`f`ng`U`b`X`G`c`W`]U`G`W`Y`b`W`g`:[\hfdg.#k k k "Ufng"i bgk "YXi "Ui #W ffYbh\]gh XYbhg#UWUXYa \]W\]bZcfa Uh\]cb#dfc hWc`g`l`i \]XY`\]bYg#](#)



7 ci fgY'8YHJ`g

7 fYX]hDc]bqg`\*`

Gi a a UfmicZ`h`Y'7 ci fgY

Gi V`Y`W`h`5`f`Y`U`.'8[^\_ E fgV[M`e

H\]g`W`i fgY`dfcj ]XYg`mci `k ]h`Ub`cddcfh b]mhc`i bXYfU`\_Y`k cf\_]b]h[ fUH`X`Y`Ufb]b[ `UbX`[ U]b`]bXi g]fm  
YI dYf]YbW`k ]h`U`cgchcf[ Ub]gU]cb`WcgY`mfY`UH`X`hc`mci f`A`U`cf`]b`:]a`G`h`X]Yg`"X`Y`U`m`z`mci`k`]"`  
i bXYfU`\_Y`Ub`]b]h]fbg\]d`U`Z`Y`f`mci` \Uj`Y`W`e`a`d`Y`H`X`%)`m`Y`U`f`g`c`Z`Z`"!`h`a`Y`g`h`X`m`f`c`f`Y`e`i`j`U`Y`b`h`U`b`X`  
W`e`a`d`Y`H`X`U`a`]b]a`i`a`c`Z`%`'I`C`7`]b`h`Y`A`U`cf`"5`h`h`Y`Y`b`X`c`Z`h`Y`]b]h]fbg\]d`mci`k`]"`dfcj ]XY`U`gi`a`a`U`h]`Y`  
f`Y`d`c`f`h`c`Z`mci`f`YI`d`Y`f]Y`b`W`g`Ub`X`k`cf`\_`YI`Ua`d`Y`g`W`e`a`d`Y`H`X`Xi`f]b[ `h`Y`]b]h]fbg\]d"

H`Y`]b]h]fbg\]d`f`Y`e`i`]f`Y`g`U`h`c`U`W`e`a`a`]h`a`Y`b`h`c`Z`%`\$`\$`!`%`\$` \`ci`fg`c`Z`k`cf`\_`k`]h`U`cgchcf[ Ub]gU]cb`Ub`X`a`Um  
bcfa`U`m`V`Y`h`U`\_`Y`b`]b`Z]f`g`h`z`g`Y`W`e`b`X`c`f`g`i`a`a`Y`f`g`Y`a`Y`g`h`Y`f`"b]h]fbg\]d`cddcfh b]h]Y`g`U`f`Y`U`X`j`Y`f]g`Y`X`j`]U`h`Y`  
G`W`X`c`c`c`Z`h`Y`'5`f`g`Ub`X`A`Y`X`]U`b]h]fbg\]d`B`Y`k`g`Y`h`Y`f`"5`h`Y`f`b`U`h]j`Y`m`mci`a`Um`U`d`d`f`c`U`W`U`f`Y`Y`j`U`b`h`  
cf[ Ub]gU]cb`hc`U`d`d`m`Z`c`f`Ub`]b]h]fbg\]d`D`f]c`f`h`c`g`Y`Y`\_]b[ `Ub`]b]h]fbg\]d`z`mci`g` \`ci`X`U`h`Y`b`X`Ub`]b]h]fbg\]d`  
]b`Z`c`fa`U`h]cb`g`Y`g`g]cb`fi`b`V`m`h`Y`G`W`X`c`c`c`Z`h`Y`'5`f`g`Ub`X`A`Y`X`]U"

`Hc`V`Y`Y`][ ]V`Y`Z`c`f`h`g`W`e`i fgY`z`mci `a`i`gh`U`j`Y`U`a`]b]a`i`a`K`5`A`c`Z`+`\$"

5`h`h`Y`W`e`b`W`i`g]cb`c`Z`h`g`W`e`i fgY`h`Y`g`h`X`Y`b`h`k`]"`V`Y`U`V`Y`h`c`

%` \Uj`Y`[ U]bYX`YI dYf]YbW`cZ]bXi g]fmdfcW`ggYg`UbX`dfUW]W`g  
&" Udd`m`h`Y`c`f`Y`h]W]`W`e`b`W`d`h`g`Ub`X`dfUW]W]`g`\_]`g`[ U]bYX`]b`h`Y`d`f`c`[ fUa`h`c`f`Y`U`!`k`c`f`X`W`e`b`h`Y`h`g`  
'`" \Uj`Y`Y`b`U`b`W`X`h`Y`f`W`U`d`U`W]m`Z`c`f]b`X`Y`d`Y`b`X`Y`b`h`Y`b[ U[ Ya`Y`b`h`k`]h`]bXi g]fmdfcj ]XYfg`

H`Y`U`W`X`]b[ `G`h`f`U`h`Y`[ ]Y`g`

H\]g`W`i fgY`U`g`bc`Z`c`fa`U`h`Y`U`W`X`]b[ `W`e`a`d`c`b`Y`b`h`"

# 5ggYgga Ybh

5ggYgga YbhHUg\_g`

5ggYgga YbhHUg_	K Y][ \h	8i Y'8UHŸ	Gh XYbh@YUfb]b[ Ci hWca Yg'5ggYggYX
7 f]h]WU`F YZYW]cb`	) \$i	&*`C WcVYF`&\$%	%ž&
K cf_`9j ]XYbW`	) \$i	&*`C WcVYF`&\$%	%ž

# 5ggYgga Ybh8YHU]`g

5ggYgga Ybh%`f]h]WU`F YZYW]cb`

GHUfhXUHŸ.`

8YHU]`g. `Gh XYbŸg`k ]`gi Va ]hU`W]h]WU`F YZYW]cb`k \]WVf]YZmXYg\$ Yg`hY`hmdY`cZcf[ Ub]nUH]cb`hYmk YfY d`UW`X`]b`UbX`hY]f`c`Y`k ]h]b`]h]XYbh]Z]Yg`U`fY`Yj`Ubhfc`Y`]b`hY`cf[ Ub]nUH]cb`Uhc`f`WcgY`h`fY`b]f`m`f`i`Yj`Y`UbX`hY`g`\_`g`UbX`Uh` i`hYg`bY`Y`X`Y`X`h`c`Wca`d`Y`H`gi`W`U`f`c`Y`U`X`X`f`Y`g`g`Y`g`l`c`k`h`Y`h`m`d`Y`c`Z`k`c`f`\_`h`Y`m`l`U`j`Y`i`b`X`Y`f`U`\_`Y`b`#`d`f`c`X`i`W`X`X`i`f`b`[`h`Y`]f`d`U`W`a`Y`b`h`V`e`b`h` i`h`Y`g`h`h`Y`]f`c`g`h`c`f`[`Ub]nUH]cb`UbX`#`c`f`f`Y`j`Ubh`]b`X`i`g`f`m`#`h`]g`U`g`h`V`e`a`d`c`b`Y`b`h`g`h`i`X`Y`b`Ÿ`g`l`c`i`X`Y`l`d`]m`h`m`f`Y`Z`Y`W`i`c`b`g`i`W`Z`U`W`c`f`g`U`g`h`Y`l`c`g`h`#`b`X`i`g`f`m`U`[`Y`b`X`U`ž`W`U`Y`b`[`Y`g`UbX`]bb`%o`Z`c`f`h`Y`l`c`g`h`#`b`X`i`g`f`m`ž`e`i`Y`g`%o`c`Z`Y`h`]W`g`k`l`W`a`U`m`U`h`c`h`]g`k`c`f`\_`ž`e`i`Y`g`%o`c`Z`]b`X`i`g`f`m`g`h`U`b`X`U`f`X`g`ž`]b`X`i`g`f`m`d`f`c`W`g`g`Y`g`c`f`a`Y`X`]U`Z`c`f`a`g`"5`W`X`Y`a`]W`f`Y`Z`f`Y`b`W`

Gi Va ]gg]cb'cZ5ggYgga YbhHUg\_g

Gh XYbng'UFY'YI dYW'X'hc'di h'AY]f'bUa Yg'UbX'ghi XYbhbi a VYfg'cb'Yj YfmdU[ Y'cZ'AY]f'Ugg][ ba Ybng"

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

zmc i 'YbWci bhYf'U'dfcV'Ya 'k \Yb'U'HYa dh]b[ 'hc'gi Va ]hmc i f'Ugg][ ba Ybh'fci [ \ 'Hi fb]h]bzd'YUgY  
HY'Yd\cbY'9I HYfbU'Gi ddcfhcb'-', ) ' ' ' %cf'Ya U]'h'Ya 'cb'[YI HYfbU'HY'fji ddcfh i bgk "YXi "Ui."](#)Gi ddcfh  
\ci fg'UFY', .\$\$Ua '-'%. \$\$da 'cb'k YY\_XUmg'UbX'-. \$\$Ua '-'). \$\$da 'cb'k YY\_YbXg'f1 \*) 'XUmg'U'mYUfL" zmc i  
UFY'i bUV'Y'hc'gi Va ]hmc i f'Ugg][ ba YbhXi Y'hc'U'ZU' 'hk ]h'Hi fb]h]b' mci 'a UmiUdd'm'Zcf'Ub'YI HYbg]cbz'Vi hmc i  
a i ghfYhU]b' mci f'h]W\_Yhbi a VYf'Z'ca '9I HYfbU'Gi ddcfhfU'cb[ 'k ]h'Ubmc'h'Yf'fY'Yj UbhXcW a Ybng'hc  
]bW' XY'Ug'Yj ]XYbW'hc'gi ddcfhmc i f'YI HYbg]cb'Udd' ]W]h]cb" zmc i 'Ya U]'9I HYfbU'Gi ddcfhmc i 'k ]`  
Ui 'ca U]W' m'fYW'j] Y'U'h]W\_Yhbi a VYfz'Vi h]Zmc i 'HY'Yd\cbY' mci 'k ]`b'YX'hc'gdYW]W' m'Ug\_'Zcf'cbY"  
Hi fb]h]b'U'gc'dfcj ]XYg'i dXUHYg'cb'h'AY]f'gmghYa 'ghU'h'g'cb'Hk ]HYf"

; YbYfU'mz'UggYgga YbhHUg\_g'a i ghVY'gi Va ]HYX'Y'YWfcb]W'mj ]U'Y]h'Yf'Hi fb]h]b'cf'U'A ccX'Y  
Ugg][ ba Ybh' b ]bg'U'bw'g'k \YfY'h' ]g' ]g'bchidcgg]V'YZ]hk ]`VY'g'U'HYX'cb' mci f'Wci fgY'g'A ccX'Y'g]HY'k ]h  
U'HYfbU]h] Y'gi Va ]gg]cb'XYhU]g"

@UH'5ggYgga YbhDYbU'h]Yg

- K cf\_gi Va ]hYX`%\$`hc`%-`XUmg`UZhf`h`Y`gh]di`UH`X`XYUX`]bY`k`j`VY`UggYggYX`UbX`ZYXVUW`dfcj`]YX`Vi`hU`a`Uf`\_`cZnYfc`k`j`VY`fYW`fYX`" `Z`h`Y`k`cf`\_`k`ci`X`\\Uj`Y`fYW`j`YX`U`dUgg`a`Uf`\_`Vi`hZcf`h`Y`UH`bYgg`UbX`h`Y`k`cf`\_`]g`U`W`a`di`gcfm`W`i`fgY`W`a`dcbYbhf`i`fX`Y`fYei`]fYa`YbH`Z`U`gh`XYbhk`j`VY`XYa`YX`h`\\Uj`Y`a`Yh`h`UhfYei`]fYa`Ybh`
- K cf\_gi Va ]hYX`&\$`cf`a`cfY`XUmg`UZhf`h`Y`gh]di`UH`X`XYUX`]bY`k`j`bchVY`UWW`dH`X`Zcf`UggYgga`Ybh`UbX`k`j`fYW`j`Y`bc`ZYXVUW`z`a`Uf`\_`cf`[`fUXY`" `Z`h`Y`UggYgga`Ybh`Ug`\_`]g`U`W`a`di`gcfm`W`a`dcbYbhc`Z`h`Y`W`i`fgY`U`gh`XYbhk`j`fYW`j`Y`Ub`l`bgUhgZUW`c`fm`:`U`]`f`l`:`k`[`fUXY`Ug`U`fYgi`h`c`Z`i`bgUhgZUW`c`fmdYfZcf`a`UbVW`]b`Ub`YggYbh]U`W`a`dcbYbhc`Z`h`Y`W`i`fgY`"

H\]g`]bZcf`a`U`h`cb`]g`U`gc`Uj`U`]\$ %ofm %o %o %o

5 WUXYa ]W<c bYghmUbX`D`U[ ]Uf]ga

D`U[ ]Uf]ga `]g`i g]b[ `hY`k cfXg`cf]XYUg`cZchYfg`UbX`dfYgYbh]b[ `hYa `Ug`mci f`ck b" `hWUb`hU`Y`a Ubm  
Zcfa gZ`Zca `XY`]VYfUHY`WXYU]b[ `hc`UWV]XYbhU`mW`dm]b[ `Zca `U`gci fW`k ]h`ci hUW\_bck`YX[ Ya Ybh`

I BGK `[ fci dg`d`U[ ]Uf]ga `]bhc`hY`Zc`ck ]b[ `WUHY[ cf]Yg.

7 cdm]b[ .`i g]b[ `hY`gUa Y`cf`j Yfmg]a ]Uf`k cfXg`hc`hY`cf][ ]bU`hYI hcf`]XYU`k ]h`ci hUW\_bck`YX[ ]b[ `hY`  
gci fW`cf`i g]b[ `ei chU]cb`a Uf\_g`"H\]g`U`gc`Udd`]Yg`hc`]a U[ YgZ`UfhUbX`XYg][ b`dfc`YWgZ`Ug`k Y`Ug  
dfYgYbhU]cbg`k \YfY`gca YcbY`dfYgYbh]g`UbchYf`g`]XYUg`cf`k cfXg`k ]h`ci hWYX]h`

hUddfcdf]UHY`dUfUd`fUg]b[ .`7`Ub[ ]b[ `U`ZYk `k cfXg`UbX`d`fUgYg`k \]Y`a cghmifYU]b]b[ `hY`cf][ ]bU`  
ghfi`W`i fY`UbX`#`f`dfc[ fYgg]cb`cZ]XYUg`cZ`hY`cf][ ]bU`Z`UbX`]bZcfa`U]cb`k ]h`ci hUW\_bck`YX[ Ya Ybh`"H\]g`U`gc  
Udd`]Yg`]b`dfYgYbhU]cbg`k \YfY`gca YcbY`dUfUd`fUgYg`UbchYf`g`]XYUg`cf`k cfXg`k ]h`ci hWYX]hU`bX`hc  
d]YW]b[ `hc[ YhYf`ei chYg`UbX`dUfUd`fUgYg`]bhc`U`bYk `k \c`Yz`k ]h`ci hUddfcdf]UHY`fYZYfYbW]b[ "

7 c`i g]cb. `k cf\_]b[ `k ]h`chYfg`Vi hdUgg]b[ `cZ`hY`k cf\_]Ug`U`dYfgcb`g`]bX]j ]Xi`U`k cf\_"`7`c`i g]cb`U`gc



- i bXYfghUbx'mci f'f][ \hg'UbX'fYgdcbg]V]h]Yg'Ug'U'gh XYbhUhl BGK
- VY'Uk UfY'cZd'U[ ]Uf]ga ž'Wc'dmf][ \hž' BGK 'Gh XYbh7cXY'cZ7cbXi W'Ubx'5W'Wd'U'V'Y'I gY'cZ  
I BGK '⇒H'F'Ygci f'W'g'Dc`]W'h
- VY'Uk UfY'cZ'Ĥ'Y'ghUbxUfXg'cZVY\Uj ]ci f'YI dY'W'X'cZYj Yfmc'by'j]b'Ĥ'Y'I BGK 'W'a a i b]m
- `cW'Ĥ'Y'gYfj ]W'g'UbX'j]bZ'fa U]cb'UVci hl BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZ'Ĥ'Y'gY'UfY'Ug'k ]`VY'ZJa ]]Uf'hc'mci ž'c'Ĥ'Y'fg'k ]`VY'bYk "; U]b]b[ 'U'gc`X'i bXYfghUbx]b[ 'cZU`Ĥ'Y  
fY'U'Ĥ'X'UgdY'W'g'cZ9@G9'k ]`Y'd'mci 'a U\_Y'Ĥ'Y'a cghcZmci f'gh X]Yg'Uhl BGK "

fl

F Ygci fWg

DfYgWf]VYX`F Ygci fWg`

BchUj U]UV`Y

F YWca a YbXYX`F Ygci fWg

BchUj U]UV`Y

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

Øf]YZmci h]bY`\ck`gh XYbhZYXVUW`fVch`Zcfa U`UbX`]bZcfa U`E`cb`hY`Wci fgY`k`J`VY`[ U`hYfYXž\ck`]h  
k`J`VY`UbU`mgYX`UbX`\ck`]hk`J`VY`UWYX`i`dcb`hc`]a`dfcj Y`hY`gh XYbh`YUfb]b[ `Yl dYf]YbW`": cf`Yl Ua`d`Yž  
mci `a`][ \hX]gW`gg`k` \Uhk`Ug`]XYbh]ZYX`]b`dUghZYXVUW`UbX`\ck`h`]g`Wci fgY`k`Ug`W`Ub[ YX`hc`UXXfYgg`hY  
]ggi Y`Q

⇒a U[ Y`7 fYX]h

6cX]Yg/` `bhfZUWg`&\$%\*

7F ⇒CG

7F ⇒CG`Dfcj ]XYf`7cXY.`\$\$-\$` , ;