



ARTS2122

DYfZcfa UbWV`DfcXi Wjcb

HYfa `Cby` `##`&\$%-



7 ci fgY`Cj Yfj]Yk

`GHZZ7cbhUWh8YHJ`g`

`7cbj Ybcfg`

B Ua Y	9a Uj`	5j U]UV]`]m	@cWjhcb	D\cbY
7 Ufc`]bY`K U_Y				

7ci fgY'8YHJ]`g

7fYX]hDc]bqg`*`

Gi a a UfmicZ\hY'7ci fgY

Gi VYWhi5fYU. FZWSfdWS` V BWdAd_ S` UWE fgV[W

H\]g'dfUW]W`gh X]c!VUgYX`Wci fgY []j Yg'mci`hY`cddcfh b]mhc`VY`]bj c`j YX`]b`hY`WfYU]cb`cZU`di V`]W
hYUhfY`dfcXi W]cb`"Mci`k`]"hU_Y`dUfh]b`Ub`Yi W]h]b[`UbX`]b]h]bg]j Y`dfcW]gg`cZg]hU[]b[`U`dYfZcfa UbW`hYi h
k]h`U`dfcZ]gg]cbU`X]fYW]c]fz`XYg][bYfz`a UbU[Yf`UbX`dfcXi W]cb`a UbU[Yf`H\]g`Wci fgY`cZ]fg`Ub`Ui`hYb]h]W
Yi dYf]YbW`cZk cf_]b[`Ug`U`hYUhfY!a U_Yfz`Ug`k Y`"Ug`hY`cddcfh b]mhc`XYj Y`cd`UbU`m]h]W`a Yh]cXg`Zc`f

Wc bHybH'K \]Y'hY'g\cfhfY\YUfgU'dYf]cX'cZHyb'dfYWi XYg'hY'dcgg]V']miZcf'Yi hYbg]j Y]bdi h'hc'hY
g\UdY'cZ'hY'Z]bU'dYfZcfa YX'dfcXi WZ'mci f'gi [[Ygh]cbg'UbX'dYfgdYW]j Yg'cb'hY'Ybei]fmUfY
fY'YX'i dcb'UhU''h]a Yg''H\Uh]gZ'hY'Wci fgY'\Y'dg'mci 'hc''YUfb'Vch'h'hc'fU_Y'X]fYW]cb'Z'ca 'U
dfcZYgg]cbU'dfUW]h]cbYfZ'UbX'hc''YUX'UbX'j]b]h]U'h'XYW]g]cbg'UbX'UW]cbg''DufhcZ'mci f'fUg_'g'hc
bUj] [U'h'h]g'Wca d'Yi 'dfcW'gg'k]h' [YbYfcg]miUbX'ja U []bUh]cb"

H\]g'Wci fgY'cZYfg'U'fUfY'cddcfhi b]mk]h]b'hY'65']b'H\YUhfY'UbX'DYfZcfa UbW'Ghi X]Yg'hc
WcgY'mYi Ua]bY'UbX'a Ub]ZYghU'Wca d'Yi 'fYgdcbgY'hc'Ub'Yi fUbhidYfZcfa UbW'hYi h'

5ggYgga Ybh

5ggYgga YbhHUg_g`

5ggYgga YbhHUg_	K Y][\h	8i Y'8UH	Gh XYbh@YUfb]b[Ci hWta Yg'5ggYggYX
7cbf]Vi h]cb'hc'DfcXi W]cb`	* \$i	: fca`h\Y`Z]fghfY\YUfgU`hc h\Y`Z]bU`dYfZcfa UbVW	%&Z ž(ž)
F YZYW]j Y`>ci fbU`	' \$i	%(# \$ #&\$%` \$) .\$\$`DA	%&Z ž*
DfcXi W]cb'6`c[`	%\$i	C b`mci f`Ugg][bYX`XUmg	&ž) ž*

5ggYgga Ybh8YHU]`g

5ggYgga Ybh%`7cbf]Vi h]cb'hc'DfcXi W]cb

GHUfhXUH.`

8YHU]`g. `8Y] Y`cdYX`h\fc [\ci hfY\YUfgU`dfcWgg`UbX`di V`]WdYfZcfa UbVWg": cfa Uh] Y`UbX`gi a a Uh] Y
ZYZXVUW`fYW]j YX`k]h]b" `k YY_g`cZ]bU`dYfZcfa UbVW"

5XX]h]cbU`XYHU]`g.

H\fc [\ci h\Y`fY\YUfgU`g`UbX`dYfZcfa UbVWg`Zc`f`#g`7ca d`]W]hX`mci `a i ghWcbf]Vi h`hc`h\Y
WcbW]j]b[ža U_]b[`UbX`dfYgYbh]b[`cZmci f`[fci d`g`h\i hVUgYX`h\YUfY`dfcXi W]cb" Hc`h\]g`YbX`mci `a i gh

5XX]h]cbU`XYHJ]g.

H\Y`>ci fbU`

H\fcI [\ci h\hY`fY\YUfgU`UbX`dYfZcfa UbW`dYf]cX`mci `UfY`YI dYW`X`hc`_YYd`U`XU]m>ci fbU`
fYW`fX]b[`mci f`dYfgcbU`cVgYfj Uh]cbg" H\Y`>ci fbU`V`bg]g]hg`cZ

%` mci f`ck b`fYW`fX`cZYj Ybhg`UbX`X]gW`gg]cbgžUbX`hUg_g`mci `a UmVY []j Yb`Xi f]b[`fY\YUfgU`/
&" mci f`ck b`fYZYW]j YždYfgcbU`žUbX`g\]Z]b[`cVgYfj Uh]cbg`cb`h\Y`dfcXi W]cb`dfcW`gg`UbX`]hg`fYgi `hg`
UbX
' " gca Y`fYZYfbW`g`hc`#bchY`g`cb`UXX]h]cbU`fYUX]b[`UbX`fYgYUfW`h\Uhmci `i bXYftU`_Y`ci hg]XY`cZ
h\Y`fY\YUfgU`fcca `fgYY`A`ccX`YŁ"

H\Y`>ci fbU`g\ci `X`VY`_Ydh]b`U`bchY`Vcc`_cZmci f`W`c]W`UbX`mci `a UmZ]bX`]h\Y`dZ`_`hc`Vf]b[`]h`c
YUW`fY\YUfgU`": cf`YI Ua`d`Yž]hW`ci `X`VY`5 (`cf`5` `]b`g]nYž`Uj`Y`fi`YX`UbX`#cf`V`Ub`_dU[`Yg`"Mci f`fYW`fXg
UbX`fYZYW]jcbgždUf]h]W`Uf`mih`cgY`mci `k`g\`hc`\Uj`Y`UggYggYXž`g\ci `X`VY`YI dYfggYX`]b`k`f]hY`b`Zcfa`"
<ck`Yj`Yfž`mci `W]b`U`gc`]bW`i`XY`ch\Y`f]j`]gi`U`a`Uhf]U`g`gi`W`Ug`]a`U[`Ygž`X]U[`fUa`gž`a`Udg`]Zmci `Z]bX`gi`W`
a`Uhf]U`j`U`i`UV`Y`Zc`f`mci`f`cVgYfj`Uh]cb`UbX`fYZYW]jcb`dfcW`gg"

C`b`gca`Y`XUmž`h\Y`>ci`fbU`k`]`ZY`_`h]a`Y`W`bgi`a`]b[`UbX`Vcf]b["`<ck`Yj`Yfž]h]h]g`k`cfh`dYfgYj`Yf]b[`ž`Ug
h]g`dfYj`]ci`g`h]fX]mY`Uf`gh`XYbhYI`d`U]bg.

"5Xa`]hY`X`nž`_YYd]b[`h\Y`_c[`Vcc`_`G`ci`fbU`Q]b]h]U`mZY`h`hYX]ci`g`UbX`_]bX`cZ]h]a`Y`W`bgi`a`]b[`ž`\ck`Yj`Yf`=
gccb`VYW]a`Y`Uk`UfY`h`Uhh\Y`]XYUg`UbX`fYU`]gUh]cbg`=\UX`Ug`U`fYgi`hc`Zc`fW]b[`a`mgY`Zhc`k`f]h`k`ci`X`bch
\Uj`Y`VYb`Uj`U]UV`Y`Ubmich\Y`f`k`Um`<`Uj`]b[`U`W`UbW`hc`g]a`d`m`W`bgc`]XUhf`U`h\Y`Z]h]b[`g`@]W`cZ
]XYUgž`i`bFYUgcbYX`W`a`di`g]cbgž`UbX`fYgcbUbh`W`bW`dhgž`bch`hc`a`Ybh]cb`h\Y`f]W`]bgd]fU]h]cbg`Zcfa`h\Y
a`Ubm]g\ck`g`UbX`Yj`Ybhg`UbX`k`\Uhbck`Y`YI`dYf]YbW`h`fci`[`\ci`h\hY`k`YY`ž`VYW]a`Y`YggYbh]U`"H\Y`f`fi`Y
a`U[`]WcZ`h\Y`_c[`Vcc`_`dfcW`gg`k`Ug`bchfYU`mUddUfYbhi`bh`h\Y`YbX`h`ci`[`\ž`k`\Yb`_YU]b[`VUW`h`fci`[`\]h
=k`Ug`UV`Y`hc`hfUW`U`dfcW`gg`h`Uh`=\UX`bchfYU`mVYYb`W`bgW]ci`g`cZUg`=k`Ug`g`VW`fS`[`Y`f`Q`a`d`Ug]g
UXXYXQ`UbX`W`ci`X`cb`mfYW`[`b]gY`]h`h`fci`[`\`YbW`ci`bh]f]b[`]hUg`U`k`\c`Y`VmifY!fYUX]b[`UbX`fYa`Ya`VYf]b[`]h
h`fci`[`\`h\Y`_c[`Vcc`_`=\UX`h`fY`f]Yg`Uh`f]h]b[`a`mZ]bU`F`YZYW]j`Y`5bU`mg]gž`h\Y`Z]fgh`hc`fYa`cj`YX`Zcfa
a`mUW]h`U`YI`dYf]YbW`ž`a`cfY`cZU`fYdc`f`hc`b`dYfZcfa`Uh]j`]m`h\Y`gYW`bXž`U`W]h]W]`fUbh`h`U`hX]Xb`f`id`Umif]Vi`hY
hc`a`midfcW`gg`k`\Uhg`Yj`Yf`"H\Y`h]fX`!`Z]bU`m`Ub`\cbYgh]bj`Ygh[`Uh]j`Y`fYgdcbgY`hc`k`\Uh`=\UX`_YUfbh!`k`Ug
cb`midcgg]V`Y`VYW]i`gY`=W`ci`X`fYZf`hc`h\Y`_c[`Vcc`_`fYdfcXi`W`X`k`]h`dYfa`]gg]cbŁ"

Z`mci`W]b`\Ub[`]b`h\Y`fYž`fYW`fX`h\Y`W]gYgž`h`fb]b[`dc]bhgž`gi`fd]gYgž`ei`Ygh]cbgž`UbX`Z]i`fYgž`mci`k`]`
\Uj`Y`gca`Yh]b[`a`i`W`a`i`W`f]W`Yf]b`A`UfW`"Z`U`_Y`gY`Z]gž`fmi`h`YgY`h`c`g]fU]h[`]Yg.

%` WYUhf`h`fY`ei`Ygh]cbg`Uh`h\Y`YbX`cZ`h\Y`XUmih`UhfYZYW]k`\Uh]g`i`f[`Ybhcf`Uf]g]b[`Zc`f`mci`"H\Y`m
a`][`\hVY`gdYW]Z]W`hc`gca`Yh]b[`mci`UfY`Xc]b[`ž`cf`a`cfY`[`YbYfU`_ei`Ygh]cbg`UVci`ha`U_]b[`h\YUhfY`/
&"`fY`h`fb`hc`U`dfYj`]ci`g`XUmUbX`c`j`Yf]k`f]hY`mci`f`Ybhf`m`k`]h`bYk`cVgYfj`Uh]cbg`"Mci`g\ci`X`U`gc`XUhf
UbmbYk`Yb]f]Yg"

H\Y`F`YZYW]jcb

F`U`h`Y`f`h`Ub`\UbX]b[`]b`h\Y`Ybh]fY`_ci`fbU`hc`h\Y`7`ci`fgY`7`cbj`Ybcfž`h]g`UggYgga`YbhUg_g`mci`hc`gY`YW]h
_YmgYW]jcbg" H\YgY`a`][`\hVY`h\Y`W]gYg`UbX`ei`Ygh]cbg`a`Ybh]cbYX`UVcj`Yž`cf`h\Y`mia`][`\h]b]c`j`Y
gca`Yh]b[`Y`gY`U[`U]b`" #`UXX]h]cbž`Uh`YUgh`cbY`Ybhfmg\ci`X`fYgdc`bX`hc`cbY`cZ`h\Y`gYhfYUX]b[`g`f`cb
A`ccX`YŁ"

>ci fbU`Ž`F`YZYW]cb`1`F`YZYW]j`Y`>ci fbU`

H\YfY`UfY`fk`c`W`a`dcbYbhg`Z`f`gi`Va`]gg]cb.

%`>ci fbU`GY`Z5ggYgga`Ybh: cfa`"H\]g`]g`B`C`H`; F`5898`Vi`hfYei`]fYX`hc`dUgg`hY`UgggYa`Ybh`

Wca d`YHX`UZf`a]Xb][\hk]`UWfi Y`ghUbxUfX`UH`bYgg`dYbU`h]Yg"

Hi fb]h]b`gYh]b[.`H\]g`]g`bchU`Hi fb]h]b`Ugg][ba Ybh

5 H\Y'U H\Y'U bXUbW'F Yei]fYa YbHg

H\Y'U H\Y'U bXUbW'cZU''fY\YUfgU'g'UbX'dYfZcfa UbW']g'a UbXUhcfm]b'h\]g'Wci fgY''I bYI W gYX'UVgYbW'g'k]' fYgi 'h]b'h\Y'Uk UfX'U': U] [fUXY"

7 ci fgY'GV\YXi `Y

[J \]Yk `WUgg`ha YhUV`Y](#)

H]a YhUV`Y`

8UH	HmdY	7cbhYbh
K YY_% '% : YVfi Ufm! '&(: YVfi Ufm		H\]g'Wci fgY'fi bg]b': YVfi UfmUbX'A UfW'UbX'a U]b`m df]cf'hc'h\Y'Wca a YbW'a YbhcZGYgg]cb`%''GYY A ccX`Y`Zcf'h\Y'fY\YUfgU'UbX'dfcXi W]cb'gW\YXi `Y"

F Ygci fWg

DfYgW]VYX`F Ygci fWg`

GYY`A ccX`Y`UbX`C b`]bY`F YUX]b[`@]gh`

F YWca a YbXYX`F Ygci fWg

GYY`A ccX`Y`UbX`C b`]bY`F YUX]b[`@]gh`

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

Gh XYbhYj U`i Uh] Y`ZYXVUW`cb`hY`Wci fgY`]g[`U`hYfYX`dYf]cX]WU`nzi`g]b[`Ua`cb[`chYf`a`YUbg`hY`
I`BGK` `a`m9I`dYf]YbW`cb`]bY`gh`XYbhWci`fgY`gi`fj`YmiZUW`]hmfgYY`
`hhdg.##YUW]b[`i`bgk`"YXi`"Ui`#a`mYI`dYf]YbW`E`"Mci`f`ZYXVUW`]g`hU`Yb`gYf]ci`g`nzi`UbX`Wcb]bi`U`
]a`dfcj`Ya`Ybhg`UfY`a`UXY`hc`hY`Wci`fgY`VUgYX`]b`dUfhcb`gi`W`ZYXVUW`" `&`&`\$`%` `hY`a`cghg][`b]ZUWbh`
W`Ub[`Y`a`UXY`hc`hY`Wci`fgY`]g`ghYUa` `]b]b[`cZ`hY`7`Ugg`6`c[`fGHU[`Y`A`UbU[`Yff]`F`Ydcf]h`]b`cfXYf`hc`a`U`_Y`
hY`hUg`_`a`cfY`a`UbU[`YUV`Y`UbX`hY`fYdcfhYUg]Yf`hc`i`gY`Vmi`hY`dfcXi`W]cb`YbgYa`V`Y`"K`]h`hY`a`cj`Y`hc`
hf]a`YghYfg`h`]g`mYUfzk`Y`Uj`Y`U`gc`UX`ghYX`hY`hja`]b[`cZgca`Y`UggYgga`Ybhg`"

Gi Va]gg]cb`cZ5ggYgga YbhHUg_g

Gi Va]gg]cb`cZ5ggYgga YbhHUg_g

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

≠mci`YbWci bHYf`U`dfcV`Ya`k`Yb`U`HYa`dh]b[`hc`gi`Va`]hmc`i`f`Ugg][`ba`Ybh`h`fci`[`\`Hi`fb]h]b`z`d`YUgY`
HY`Yd`cbY`9I`HYfbU`Gi`ddcfhcb`-`,`),`"`,`'`,`%`cf`Ya`U]`h`Ya`cb`YI`HYfbU`HY`hgi`ddcfh4`i`bgk`"YXi`"Ui`"Gi`ddcfh`
`ci`fg`UfY`,`.\$\$Ua`-`%\$.\$\$da`cb`k`YY`XUmg`UbX`-`.\$\$Ua`-`).\$\$da`cb`k`YY`YbXg`fI`*)`XUmg`U`mY`UfL`≠mci`
UfY`i`bUV`Y`hc`gi`Va`]hmc`i`f`Ugg][`ba`YbhXi`Y`hc`U`ZU`ihk`]h`Hi`fb]h]b`mci`a`Um`Udd`mi`Zc`f`Ub`YI`HYbg]cb`z`Vi`hmc`i`
a`i`gh`fY`hU]b`mci`f`h]W`Yhbi`a`VYf`Zca`9I`HYfbU`Gi`ddcfhfU`cb[`k`]h`Ubmc`h`Yf`fY`Yj`UbhXcW`a`Yb`hg`L`hc`
]bWi`XY`Ug`Yj`]XYbW`hc`gi`ddcfhmc`i`f`YI`HYbg]cb`Udd`]W]h]cb`≠mci`Ya`U]`9I`HYfbU`Gi`ddcfhmc`i`k`]`

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 hW`YX]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`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 hW`YX]h`UbX`hc
d]YW]b[`hc[Y`hYf`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
]bWi XYg`dfcj]X]b[`mci f`k cf_]hc`UbchYf`gh`XYbhVYZc`fY`hY`Xi Y`XUHY`Zc`f`Zc`hY`di fdcgY`cZ`hY`a

- i bXYfghUjX'mci f'f][\hg'UbX'fYgdcbg]V]h]Yg'Ug'U'gh XYbhUhl BGK
- VY'Uk UfY'cZd'U[]Uf]ga ž'Wc'dmf][\hžI BGK 'Gh XYbh7cXY'cZ7cbXi W'UjX'5W'W'dhUV'Y'I gY'cZ I BGK '⇒H'F'Ygci f'W'g'Dc`]W'h
- VY'Uk UfY'cZ'Y'ghUjX'UfX'g'cZVY\Uj]ci f'YI dY'W'X'cZYj Yfmc'bY']b'h'Y'I BGK 'W'a a i b]m
- `cW'Uj'gYfj]W'g'UbX']bZ'c'fa U]cb'UVci hi BGK 'UbX'I BGK '@]VfUfm

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

[\h'c. #g\] V'Y'W'f i \]X'Y'g" \]V'f'U'f'm'i b'g'k "Y'X'i "U'i #'\]g'Y'#\]V'c'i h'Y' \]g'Y](#)

5 WUXYa]WbZcfa Uhcb`

: cfYggYbh]U`ghi XYbh]bZcfa Uhcb`fY`Uh]b[`hc.

- fYei Yghg`ZcfYI hYbg]cb/
- `UhY`gi Va]gg]cbg`[i]XY`]bYg/
- fYj]Yk `cZa Uf_g/
- I BGK `<YU`h`UbX`GUZY`midc`]WYg/
- YI Ua]bUh]cb`dfcVWXi fYg/
- gdYW]U`Vc]bg]XYfUh]cb`]b`hY`Yj Ybhcz]`bYgg`cf`a]gUXj Ybh fY/
- ghi XYbhYei]hmUbX`X]gUV`]`hm/
- UbX`chYfYggYbh]U`UWUXYa]W]bZcfa Uh]cbz`gYY

[\hfdg.#k k k "Ufmg"i bgk "YXi "Ui #W ffYbh\]ghi XYbh\]bZcfa Uh\]cb`dfc\]cVc`g!\[i \]XY`\]bYg#](#)

⇒ U[Y`7 fYX]h