



Table 2

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #1 (Pre-Departure)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 | Behavior 5 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|------------|
| PIC        | 3.1009 | .4331 | 1.000  |        |        |           |            |            |            |            |            |
| SIC        | 3.1364 | .4315 | .642** | 1.000  |        |           |            |            |            |            |            |
| CRM        | 3.1477 | .4211 | .644** | .664** | 1.000  |           |            |            |            |            |            |
| Technical  | 3.0597 | .4325 | .583** | .589** | .608** | 1.000     |            |            |            |            |            |
| Behavior 1 | 2.8693 | .3883 | .205** | .234** | .231** | .224**    | 1.000      |            |            |            |            |
| Behavior 2 | 2.9318 | .2522 | .089** | .138** | .149** | .089**    | .417**     | 1.000      |            |            |            |
| Behavior 3 | 2.7940 | .4876 | .193** | .215** | .218** | .193**    | .639**     | .302**     | 1.000      |            |            |
| Behavior 4 | 2.9645 | .1852 | .062   | .150** | .086** | .009      | .291**     | .344**     | .187**     | 1.000      |            |
| Behavior 5 | 2.9389 | .2396 | .183** | .094** | .188** | .186**    | .174**     | .237**     | .123**     | .207**     | 1.000      |

Note: Listwise N = 352 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 3

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #2 (Taxi Out)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|
| PIC        | 3.1520 | .4429 | 1.000  |        |        |           |            |            |            |            |
| SIC        | 3.1576 | .4345 | .666** | 1.000  |        |           |            |            |            |            |
| CRM        | 3.1980 | .4842 | .687** | .708** | 1.000  |           |            |            |            |            |
| Technical  | 3.0907 | .4889 | .639** | .689** | .620** | 1.000     |            |            |            |            |
| Behavior 1 | 2.9303 | .2549 | .119** | .024   | .089** | .073*     | 1.000      |            |            |            |
| Behavior 2 | 2.9512 | .2156 | .019   | .082** | .039   | .095*     | .370**     | 1.000      |            |            |
| Behavior 3 | 2.9400 | .2376 | .113** | .146** | .249** | .119**    | .277**     | .243**     | 1.000      |            |
| Behavior 4 | 2.8703 | .4341 | .045   | .175** | .122** | .128**    | .057       | .186**     | .182**     | 1.000      |

Note: Listwise N = 358 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 4

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #3 (Climb)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|
| PIC        | 3.0559 | .4093 | 1.000  |        |        |           |            |            |            |            |
| SIC        | 3.0531 | .4361 | .516** | 1.000  |        |           |            |            |            |            |
| CRM        | 3.0978 | .4250 | .652** | .568** | 1.000  |           |            |            |            |            |
| Technical  | 2.9930 | .4861 | .614** | .602** | .606** | 1.000     |            |            |            |            |
| Behavior 1 | 2.9148 | .2892 | .253** | .236** | .182** | .314**    | 1.000      |            |            |            |
| Behavior 2 | 2.5573 | .6039 | .247** | .212** | .136** | .256**    | .176**     | 1.000      |            |            |
| Behavior 3 | 2.6564 | .5066 | .309** | .235** | .202** | .337**    | .220**     | .375**     | 1.000      |            |
| Behavior 4 | 2.8673 | .3672 | .254** | .219** | .173** | .269**    | .381**     | .372**     | .303**     | 1.000      |

Note: Listwise N = 358 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 5

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #4 (Cruise)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 | Behavior 5 | Behavior 6 | Behavior 7 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|------------|------------|------------|
| PIC        | 3.0074 | .6078 | 1.000  |        |        |           |            |            |            |            |            |            |            |
| SIC        | 3.0622 | .6227 | .736** | 1.000  |        |           |            |            |            |            |            |            |            |
| CRM        | 3.0207 | .6349 | .757** | .740** | 1.000  |           |            |            |            |            |            |            |            |
| Technical  | 2.9333 | .6187 | .712** | .646** | .657** | 1.000     |            |            |            |            |            |            |            |
| Behavior 1 | 2.9319 | .2637 | .244** | .261** | .257** | .245**    | 1.000      |            |            |            |            |            |            |
| Behavior 2 | 2.9141 | .3009 | .271** | .242** | .343** | .216**    | .150**     | 1.000      |            |            |            |            |            |
| Behavior 3 | 2.7215 | .4867 | .403** | .405** | .432** | .411**    | .222**     | .211**     | 1.000      |            |            |            |            |
| Behavior 4 | 2.7778 | .4568 | .401** | .372** | .440** | .310**    | .317**     | .314**     | .435**     | 1.000      |            |            |            |
| Behavior 5 | 2.8267 | .4090 | .387** | .340** | .397** | .324**    | .193**     | .421**     | .361**     | .405**     | 1.000      |            |            |
| Behavior 6 | 2.8133 | .4085 | .274** | .203** | .255** | .274**    | .075       | .207**     | .298**     | .366**     | .286**     | 1.000      |            |
| Behavior 7 | 2.8667 | .3890 | .287** | .285** | .372** | .296**    | .229**     | .358**     | .391**     | .342**     | .451**     | .459**     | 1.000      |

Note: Listwise N = 337 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 6

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #5 (Descent)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 | Behavior 5 | Behavior 6 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|------------|------------|
| PIC        | 3.0501 | .5011 | 1.000  |        |        |           |            |            |            |            |            |            |
| SIC        | 3.1302 | .4923 | .647** | 1.000  |        |           |            |            |            |            |            |            |
| CRM        | 3.0944 | .5214 | .684** | .639** | 1.000  |           |            |            |            |            |            |            |
| Technical  | 2.9914 | .5134 | .564** | .537** | .528** | 1.000     |            |            |            |            |            |            |
| Behavior 1 | 2.7725 | .5417 | .221** | .122** | .132** | .230**    | 1.000      |            |            |            |            |            |
| Behavior 2 | 2.8770 | .3539 | .334** | .265** | .343** | .270**    | .377**     | 1.000      |            |            |            |            |
| Behavior 3 | 2.8627 | .3527 | .290** | .210** | .390** | .160**    | .009       | .427**     | 1.000      |            |            |            |
| Behavior 4 | 2.8629 | .4147 | .331** | .195** | .361** | .235**    | .041       | .235**     | .366**     | 1.000      |            |            |
| Behavior 5 | 2.7668 | .4651 | .210** | .183** | .345** | .136**    | .017       | .339**     | .494**     | .340**     | 1.000      |            |
| Behavior 6 | 2.9099 | .2964 | .301** | .257** | .333** | .164**    | .068       | .318**     | .320**     | .397**     | .398**     | 1.000      |

Note: Listwise N = 350 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 7

Descriptive Statistics for All Variables in LOE Alpha (Observable Behaviors), Event Set #6 (Approach)

| Variable   | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Behavior 1 | Behavior 2 | Behavior 3 | Behavior 4 | Behavior 5 | Behavior 6 |
|------------|--------|-------|--------|--------|--------|-----------|------------|------------|------------|------------|------------|------------|
| PIC        | 3.0415 | .5486 | 1.000  |        |        |           |            |            |            |            |            |            |
| SIC        | 3.1452 | .5048 | .701** | 1.000  |        |           |            |            |            |            |            |            |
| CRM        | 3.1363 | .5073 | .630** | .682** | 1.000  |           |            |            |            |            |            |            |
| Technical  | 3.0267 | .5784 | .604** | .561** | .559** | 1.000     |            |            |            |            |            |            |
| Behavior 1 | 2.8207 | .4346 | .448** | .322** | .272** | .497**    | 1.000      |            |            |            |            |            |
| Behavior 2 | 2.9067 | .2962 | .207** | .200** | .292** | .309**    | .458**     | 1.000      |            |            |            |            |
| Behavior 3 | 2.8030 | .4268 | .282** | .298** | .378** | .226**    | .369**     | .336**     | 1.000      |            |            |            |
| Behavior 4 | 2.9126 | .2980 | .222** | .262** | .275** | .212**    | .360**     | .513**     | .296**     | 1.000      |            |            |
| Behavior 5 | 2.8800 | .3386 | .266** | .258** | .303** | .274**    | .418**     | .450**     | .370**     | .440**     | 1.000      |            |
| Behavior 6 | 2.8356 | .4974 | .210** | .107** | .112** | .113**    | .186**     | .218**     | .127**     | .123**     | .191**     | 1.000      |

Note: Listwise N = 337 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 8

Summary Results for the Path Analyses Based on the Six Event Sets in LOE Alpha (Observable Behaviors)

| Event Set Title              | Number of Observable Behaviors | R <sup>2</sup> CRM | R <sup>2</sup> Technical | R <sup>2</sup> PIC | R <sup>2</sup> SIC |
|------------------------------|--------------------------------|--------------------|--------------------------|--------------------|--------------------|
| Pre-Departure                | 5                              | .085               | .084                     | .473               | .495               |
| Taxi-Out                     | 4                              | .070               | .029                     | .545               | .602               |
| Climb                        | 4                              | .067               | .192                     | .501               | .428               |
| Cruise                       | 7                              | .332               | .242                     | .654               | .592               |
| Descent                      | 6                              | .262               | .127                     | .525               | .463               |
| Approach                     | 6                              | .196               | .258                     | .489               | .512               |
| <b>Average R<sup>2</sup></b> |                                | .145               | .133                     | .455               | .442               |

Note: CRM and Technical Performance ratings were regressed onto all observable behaviors simultaneously. PIC and SIC ratings were regressed onto CRM and Technical performance ratings simultaneously.

Table 9

Comparison of the Beta Weights in PIC and SIC Performance Ratings in LOE Alpha (Observable Behaviors)

| Event Set Title                   | PIC         |                   |                          | SIC         |                   |                          |
|-----------------------------------|-------------|-------------------|--------------------------|-------------|-------------------|--------------------------|
|                                   | $\beta$ CRM | $\beta$ Technical | Significance             | $\beta$ CRM | $\beta$ Technical | Significance             |
| Pre-Departure                     | .459        | .304              | $t_{(349)} = 2.034^*$    | .485        | .294              | $t_{(349)} = 2.560^*$    |
| Taxi-Out                          | .471        | .347              | $t_{(355)} = 1.647$      | .456        | .406              | $t_{(355)} = .710$       |
| Climb                             | .443        | .345              | $t_{(355)} = 1.183$      | .321        | .408              | $t_{(355)} = -.981$      |
| Cruise                            | .509        | .377              | $t_{(334)} = 1.870$      | .555        | .282              | $t_{(334)} = 3.561^{**}$ |
| Descent                           | .535        | .282              | $t_{(346)} = 3.346^{**}$ | .492        | .278              | $t_{(346)} = 2.662^{**}$ |
| Approach                          | .425        | .367              | $t_{(334)} = .724$       | .535        | .262              | $t_{(334)} = 3.489^{**}$ |
| <b>Average <math>\beta</math></b> | <b>.406</b> | <b>.289</b>       |                          | <b>.406</b> | <b>.276</b>       |                          |

\*\* . t-value is significant at the 0.01 level (1-tailed).

\* . t-value is significant at the 0.05 level (1-tailed).

Table 10

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #1 (Pre-Departure to Taxi-Out)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 | Topic 3 | Topic 4 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|---------|---------|
| PIC       | 3.2175 | .5751 | 1.000  |        |        |           |         |         |         |         |
| SIC       | 3.1448 | .5836 | .675** | 1.000  |        |           |         |         |         |         |
| CRM       | 3.2360 | .5519 | .750** | .665** | 1.000  |           |         |         |         |         |
| Technical | 3.0656 | .6242 | .666** | .556** | .652** | 1.000     |         |         |         |         |
| Topic 1   | 2.8469 | .4223 | .247** | .194** | .234** | .227**    | 1.000   |         |         |         |
| Topic 2   | 2.8262 | .4680 | .213** | .204** | .230** | .197**    | .400**  | 1.000   |         |         |
| Topic 3   | 2.3645 | .6417 | .339** | .383** | .318** | .425**    | .300**  | .235**  | 1.000   |         |
| Topic 4   | 2.8299 | .4522 | .180** | .158** | .200** | .160**    | .411**  | .590**  | .205**  | 1.000   |

Note: Listwise N = 823 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 11

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #2 (Take-Off to Top of Climb)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 | Topic 3 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|---------|
| PIC       | 3.2578 | .5543 | 1.000  |        |        |           |         |         |         |
| SIC       | 3.2400 | .5867 | .805** | 1.000  |        |           |         |         |         |
| CRM       | 3.2711 | .5599 | .812** | .769** | 1.000  |           |         |         |         |
| Technical | 3.1663 | .5842 | .734** | .677** | .706** | 1.000     |         |         |         |
| Topic 1   | 2.7627 | .5058 | .257** | .282** | .257** | .296**    | 1.000   |         |         |
| Topic 2   | 2.8663 | .3991 | .199** | .209** | .205** | .209**    | .392**  | 1.000   |         |
| Topic 3   | 2.8627 | .4397 | .195** | .165** | .195** | .206**    | .569**  | .541**  | 1.000   |

Note: Listwise N = 830 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 12

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #3 (Top of Climb to FL 280)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|
| PIC       | 2.8954 | .8366 | 1.000  |        |        |           |         |         |
| SIC       | 2.8869 | .8377 | .939** | 1.000  |        |           |         |         |
| CRM       | 2.9429 | .8239 | .895** | .899** | 1.000  |           |         |         |
| Technical | 2.8615 | .8442 | .903** | .875** | .902** | 1.000     |         |         |
| Topic 1   | 2.0571 | .8712 | .648** | .640** | .636** | .658**    | 1.000   |         |
| Topic 2   | 2.1154 | .8958 | .624** | .621** | .615** | .625**    | .832**  | 1.000   |

Note: Listwise N = 822 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 13

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #4 (Dangerous Goods Incident)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 | Topic 3 | Topic 4 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|---------|---------|
| PIC       | 3.1119 | .7182 | 1.000  |        |        |           |         |         |         |         |
| SIC       | 3.1644 | .6830 | .755** | 1.000  |        |           |         |         |         |         |
| CRM       | 3.1594 | .7303 | .783** | .729** | 1.000  |           |         |         |         |         |
| Technical | 3.0657 | .6929 | .723** | .694** | .688** | 1.000     |         |         |         |         |
| Topic 1   | 2.8455 | .4673 | .182** | .206** | .194** | .170**    | 1.000   |         |         |         |
| Topic 2   | 2.5718 | .6155 | .420** | .330** | .399** | .368**    | .502**  | 1.000   |         |         |
| Topic 3   | 2.7871 | .5536 | .268** | .241** | .319** | .242**    | .456**  | .568**  | 1.000   |         |
| Topic 4   | 2.6910 | .5489 | .338** | .298** | .366** | .283**    | .583**  | .602**  | .528**  | 1.000   |

Note: Listwise N = 822 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 14

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #5 (Top of Descent to Final Approach)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 | Topic 3 | Topic 4 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|---------|---------|
| PIC       | 3.2397 | .6479 | 1.000  |        |        |           |         |         |         |         |
| SIC       | 3.2182 | .6295 | .811** | 1.000  |        |           |         |         |         |         |
| CRM       | 3.2627 | .6604 | .802** | .761** | 1.000  |           |         |         |         |         |
| Technical | 3.1644 | .6467 | .804** | .739** | .739** | 1.000     |         |         |         |         |
| Topic 1   | 2.7990 | .5240 | .310** | .306** | .341** | .284**    | 1.000   |         |         |         |
| Topic 2   | 2.7833 | .5394 | .298** | .261** | .251** | .279**    | .613**  | 1.000   |         |         |
| Topic 3   | 2.7688 | .5578 | .291** | .279** | .290** | .274**    | .624**  | .747**  | 1.000   |         |
| Topic 4   | 2.7530 | .5757 | .289** | .273** | .272** | .223**    | .707**  | .697**  | .708**  | 1.000   |

Note: Listwise N = 826 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 15

Descriptive Statistics for All Variables in LOE Bravo (Topic-Level Ratings), Event Set #6 (Final Approach to Taxi In)

| Variable  | Mean   | SD    | PIC    | SIC    | CRM    | Technical | Topic 1 | Topic 2 | Topic 3 |
|-----------|--------|-------|--------|--------|--------|-----------|---------|---------|---------|
| PIC       | 3.2085 | .7172 | 1.000  |        |        |           |         |         |         |
| SIC       | 3.1952 | .7201 | .862** | 1.000  |        |           |         |         |         |
| CRM       | 3.2446 | .7001 | .864** | .850** | 1.000  |           |         |         |         |
| Technical | 3.1634 | .7292 | .825** | .815** | .857** | 1.000     |         |         |         |
| Topic 1   | 2.7494 | .5794 | .461** | .438** | .417** | .422**    | 1.000   |         |         |
| Topic 2   | 2.8245 | .5062 | .388** | .368** | .381** | .348**    | .746**  | 1.000   |         |
| Topic 3   | 2.8390 | .4868 | .363** | .354** | .375** | .341**    | .694**  | .809**  | 1.000   |

Note: Listwise N = 825 crews

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 16

Summary Results for the Path Analyses Based on the Six Event Sets in LOE Bravo (Topic-Level Ratings)

| Event Set Title                  | Number of Topics | R <sup>2</sup> CRM | R <sup>2</sup> Technical | R <sup>2</sup> PIC | R <sup>2</sup> SIC |
|----------------------------------|------------------|--------------------|--------------------------|--------------------|--------------------|
| Pre-Departure to Taxi Out        | 4                | .137               | .197                     | .614               | .468               |
| Take-Off to Top of Climb         | 3                | .079               | .098                     | .711               | .627               |
| Top of Climb to FL 280           | 2                | .428               | .453                     | .848               | .830               |
| Dangerous Goods Incident         | 4                | .196               | .145                     | .677               | .602               |
| Top of Descent to Final Approach | 4                | .126               | .104                     | .742               | .648               |
| Final Approach to Taxi-In        | 3                | .190               | .185                     | .774               | .750               |
| <b>Average R<sup>2</sup></b>     |                  | <b>.165</b>        | <b>.169</b>              | <b>.624</b>        | <b>.561</b>        |

Note: CRM and Technical Performance ratings were regressed onto all topic-level ratings simultaneously. PIC and SIC ratings were regressed onto CRM and Technical performance ratings simultaneously.

Table 17

Comparison of the Beta Weights in PIC and SIC Performance Ratings in LOE Bravo (Topic-Level Ratings)

| Event Set Title                   | PIC         |                   |                           | SIC         |                   |                           |
|-----------------------------------|-------------|-------------------|---------------------------|-------------|-------------------|---------------------------|
|                                   | $\beta$ CRM | $\beta$ Technical | Significance              | $\beta$ CRM | $\beta$ Technical | Significance              |
| Pre-Departure to Taxi Out         | .549        | .306              | $t_{(820)} = 4.645^{***}$ | .526        | .213              | $t_{(820)} = 5.094^{***}$ |
| Take-Off to Top of Climb          | .583        | .323              | $t_{(827)} = 5.355^{***}$ | .580        | .267              | $t_{(827)} = 5.649^{***}$ |
| Top of Climb to FL 280            | .433        | .511              | $t_{(819)} = -1.267$      | .591        | .342              | $t_{(819)} = 3.824^{***}$ |
| Dangerous Goods Incident          | .544        | .348              | $t_{(819)} = 3.933^{***}$ | .478        | .365              | $t_{(819)} = 2.041^*$     |
| Top of Descent to Final Approach  | .456        | .468              | $t_{(823)} = -.246$       | .474        | .389              | $t_{(822)} = 1.491$       |
| Final Approach to Taxi-In         | .590        | .320              | $t_{(822)} = 4.381^{***}$ | .565        | .331              | $t_{(822)} = 3.610^{***}$ |
| <b>Average <math>\beta</math></b> | <b>.451</b> | <b>.325</b>       |                           | <b>.459</b> | <b>.272</b>       |                           |

\*\*. t-value is significant at the 0.01 level (1-tailed).

\*. t-value is significant at the 0.05 level (1-tailed).